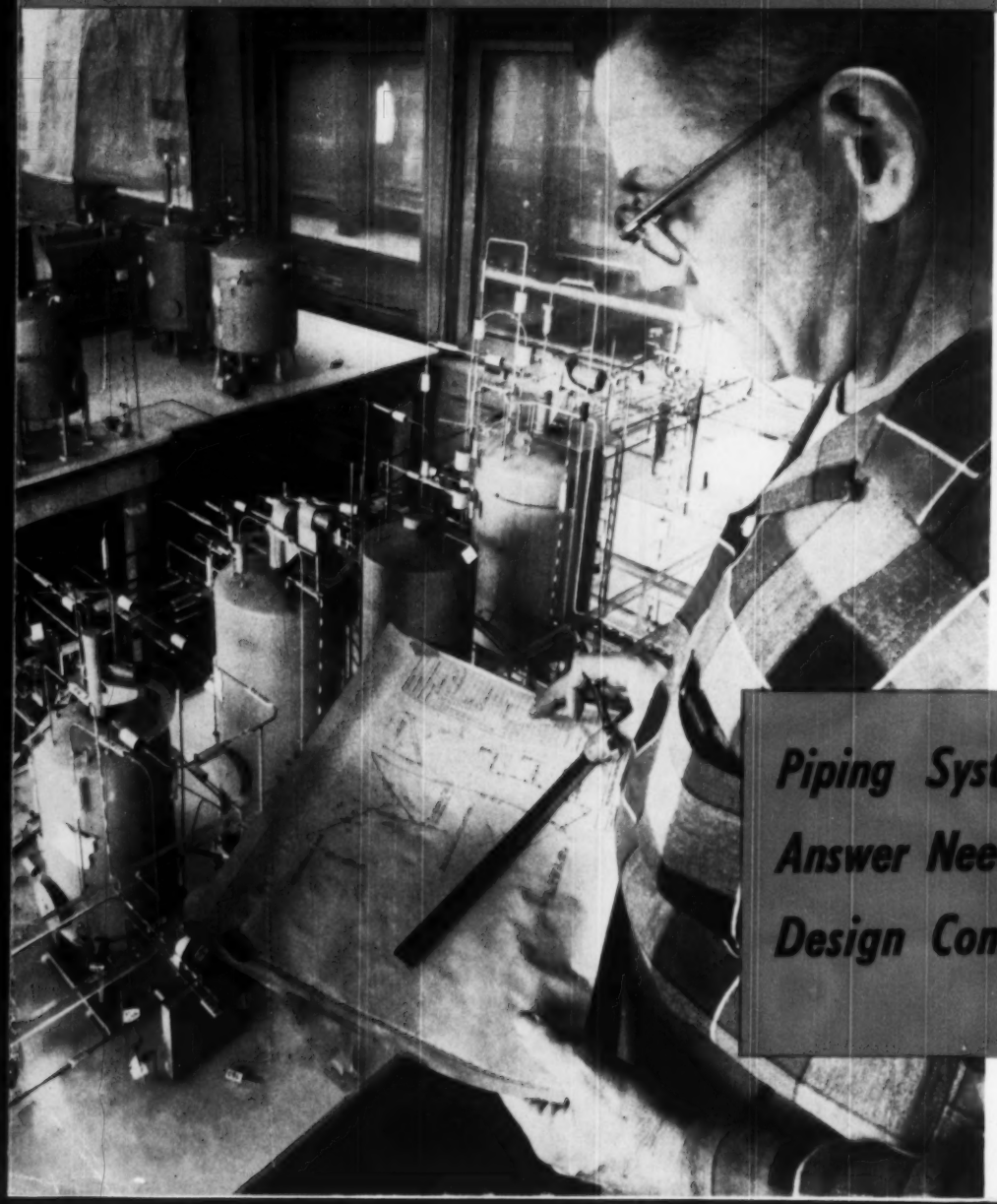
# Heating Piping & Air Conditioning

JULY 1958

Single copy price 75c

Contents ..... page 5

. . . for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings



**Ventilate Vehicle Tunnel By Transverse System**
.... page 79

**Flexible Systems Serve Plant's Heating, Cooling**
.... page 83

**ASHAE Journal Section**
.... page 111

## *Piping System Models Answer Need for Better Design Communication*

. . . page 69

## for greater strength . . . easier assembly

# The new Grinnell Wedge Type Concrete Insert

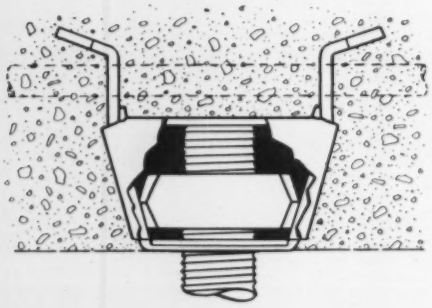
Fig. 281

**NEW** design features give Grinnell's Wedge Type Concrete Insert (Fig. 281) greater load carrying capacity . . . 1200 lbs. for ⅝" and ¾" sizes, with a safety factor of at least 5 to 1.

Heavy gauge steel is die-formed into a wedge-shaped box housing. When load is attached to the inserted nut and rod assembly, ends of the elongated nut press on the wedge-slanted walls.

These walls, acting in compression with the concrete, provide strength unmatched in steel inserts of equal size.

Preassembly of the elongated nut on the rod makes quick assembly possible.



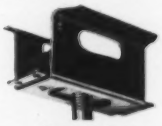
Installations can be made in quick time, too. Just a few turns of the rod tighten the nut rigidly in place. Slightly loosening the nut permits lateral adjustment along the full length of the slot, without fear of rod and nut falling out of the body.

Single body size accommodates four different interchangeable nut and rod sizes, to make ordering easier and installation simpler—especially where hanger rod sizes cannot be determined in advance of ceiling construction.

On your next project, specify Grinnell Concrete Inserts — either steel or malleable iron. Quality manufactured . . . *and priced right!* Grinnell Company, Inc., Providence 1, R. I.

CB-Universal Malleable Iron Concrete Insert (Fig. 282)

CB-Junior Malleable Iron Concrete Insert (Fig. 279)



Wrought Steel Concrete Insert (Fig. 280)

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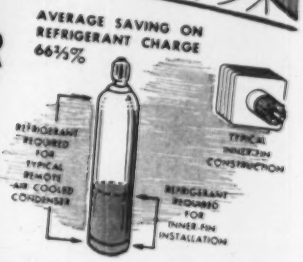
A DIVISION OF
American Machine and Metals, Inc
EAST MOLINE, ILLINOIS

*What's NEW in Remote Air Cooled Condensers?* *This*

# A REMOTE AIR COOLED CONDENSER THAT REQUIRES ONLY 1/3 OF THE REFRIGERANT CHARGE USED BY COMPETITIVE MODELS

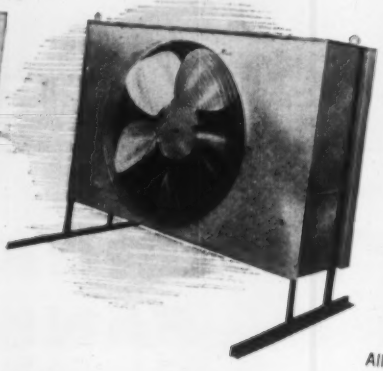

AVERAGE SAVING ON REFRIGERANT CHARGE 66⅔%
REFRIGERANT REQUIRED FOR TYPICAL REMOTE AIR COOLED CONDENSER
TYPICAL INNER-FIN CONSTRUCTION
REFRIGERANT REQUIRED FOR INNER-FIN INSTALLATION

**A RECENT 300 TON JOB SHOWED SAVINGS OF 1800 LBS. OF REFRIGERANT THROUGH USE OF THESE UNITS.**

Yes, the Dunham-Bush 'BC' Remote Air Cooled Condensers with famous Inner-Fin construction mean savings of 67% in refrigerant charge. Additionally, they mean smaller receivers and minimum loss if the system charge is lost. In these expertly planned units, the exclusive Inner-Fin construction diminishes the internal volume of the coil while increasing the heat transfer coefficient. And higher heat transfer factors permit design of more compact units, saving valuable space in installation.

**AS MUCH AS 53.5 TON CAPACITY IN ONE UNIT**

The Dunham-Bush line of 'BC' Remote Air Cooled Condensers includes models in 13 sizes with capacities ranging from 2.2 tons to 53.5 tons, making possible use of a single unit for practically any job!



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All interior surfaces of the unit casing are given an extra finish coat of plastic vinyl.

**AND FOR MAINTAINING SATISFACTORY HEAD PRESSURES**

at all ambients, Dunham-Bush engineers offer the 'PS' Pressure Stabilizer.

'PS' units can be mounted indoors near the compressor, facilitating the making of necessary adjustments. They are thoroughly factory tested and assembled, and require connection only to the refrigerant liquid and discharge lines. No extra piping or special loops required. Regulating valve gives smooth pressure control and eliminates wide pressure fluctuations inherent in other head control systems.

The name Dunham-Bush is synonymous with efficient, satisfactory service for all types of pressure and temperature conditions. For technical assistance, our engineering staff is at your service. For more information, contact us.

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# Heating Piping & Air Conditioning

Vol. 30, No. 7

July 1958

(With which is merged the Aerologist)

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## FEATURES


**Piping System Models Aid Design Communication** ..... 69
G. P. Hammond

**Mechanical (HPAC) Contractors Defer Action on Merger** ..... 72
At 69th annual meeting

**"Bid Shopping Bill Dangerous to Both Contractors, Union"** ..... 74
Peter T. Schoemann addresses MCAA

**Fan-Coil System Completes Cooling of Existing Office Building** .... 76
M. F. Stearn and Robert Masamitsu

**"Transverse" Tunnel Ventilation Assures Uniform Distribution** .... 79
H. G. Cruthers

**Design for Flexibility to Serve Plant's Heating, Cooling Needs** ..... 83
E. H. Roper

**Condition Jail for Health, Security** ..... 85
Air conditioning permits windowless cells

**Combat Tower Water Dirt Buildup through Good Housekeeping** .... 86
H. L. Shuldener, Jr.

**PVC Piping Proves Maintenance-Free in Pickle Plant Operation** .... 88
L. J. Turney

**Industrial Ventilation: How Is Its Equipment Selected?** ..... 91
John H. Clarke

**Case Histories from a Consulting Engineer's Files** ..... 97
C. T. Baker

**Here Are Fundamentals of Conditioning Compressed Air** ..... 99
Frank D. Ross

**Low Pressure Steam Zone System Meets Varied Heating Demands** .. 102
Paul S. Amber and George H. Amber

**The Law and Your Profits** ..... 105
Remedy, liability are not synonymous

**How to Prevent Weld Failures in Nuclear Power Piping** ..... 106
V. T. Malcolm and Sidney Low


## DATA SHEET


**How to Cut Cooling Costs** ..... 109
Willie Hammer


## ASHAE JOURNAL SECTION


**Annual Energy Use for Electric Space Heating** ..... 113
R. L. Boyd

**Omni-Directional, Low Speed, Hot Wire Anemometer** ..... 117
J. F. Kemp

**Heat Gain Through Windows Shaded by Metal Awnings** ..... 121
Necati Ozisik and L. F. Schutrum

**How Research Can Improve Fibrous and Reflective Insulation** ..... 126
William Turbeville

**A New Method for Calculating Radiant Exchanges** ..... 131
Benjamin Gebhart

**Surfacings for Glass Fiber and Foam Thermal Insulation** ..... 136
W. F. Ellis



*For complete Journal Section table of contents see page 111*


## DEPARTMENTS


**The Editors' Pages** ..... 55
**"Open for Discussion"** ..... 59
**Question of the Month** ..... 64
**Equipment Developments** .... 157
**Recent Trade Literature** ..... 232
**Who's What** ..... 248
**In the Territories** ..... 254
**We Hear That** ..... 260
**Meetings and Conventions** ... 264
**New Books and Reports** ..... 268

***Index to Advertisers*** ..... **272**

# How Much Steam Should a Steam Trap Trap?

## . . . some answers to commonly asked questions about the primary job of a steam trap

You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap all the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

### A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

### A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

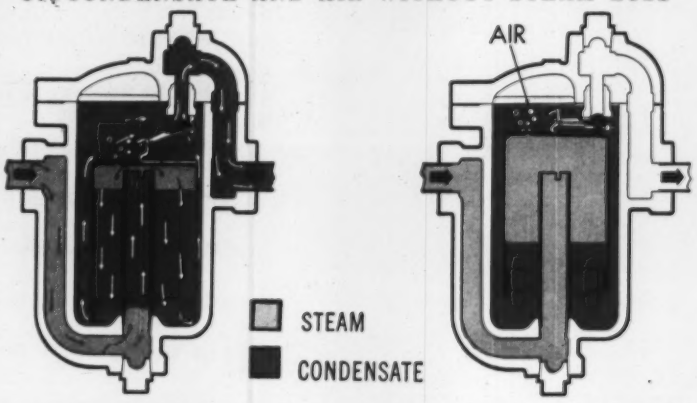
### A Steam Trap Should Remove Air and $CO_2$

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. $CO_2$ goes into solution to form corrosive carbonic acid which, for example, can eat unit heater tubes. $O_2$ aggravates the situation. Believe it or not, but all traps don't properly remove air and $CO_2$.

By now, you've probably guessed that Armstrong traps *do* remove air and $CO_2$. Armstrong design (see illustration) provides continuous venting of air and $CO_2$. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

*Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.*

HERE'S THE STEAM TRAP DESIGN THAT GETS RID OF CONDENSATE AND AIR WITHOUT STEAM LOSS




*Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.*

*Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.*

### What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

### Put Up or Shut Up

We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

* * *

The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

**Armstrong Machine Works**
**8747 Maple Street**
**Three Rivers, Michigan**

**ARMSTRONG STEAM TRAPS**

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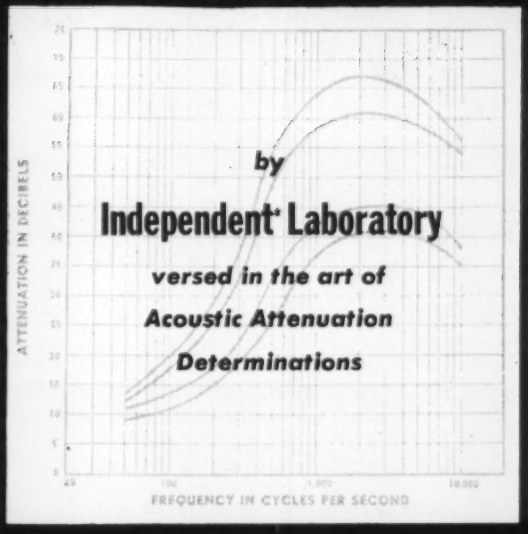


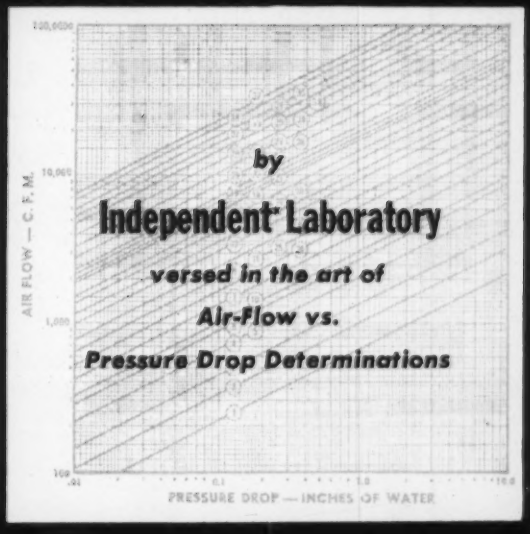


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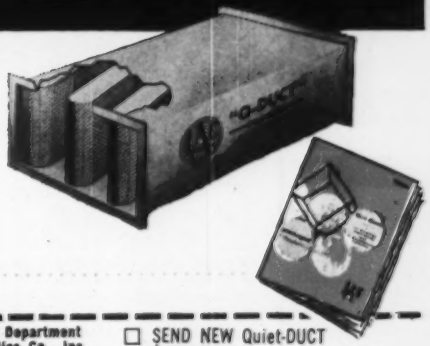


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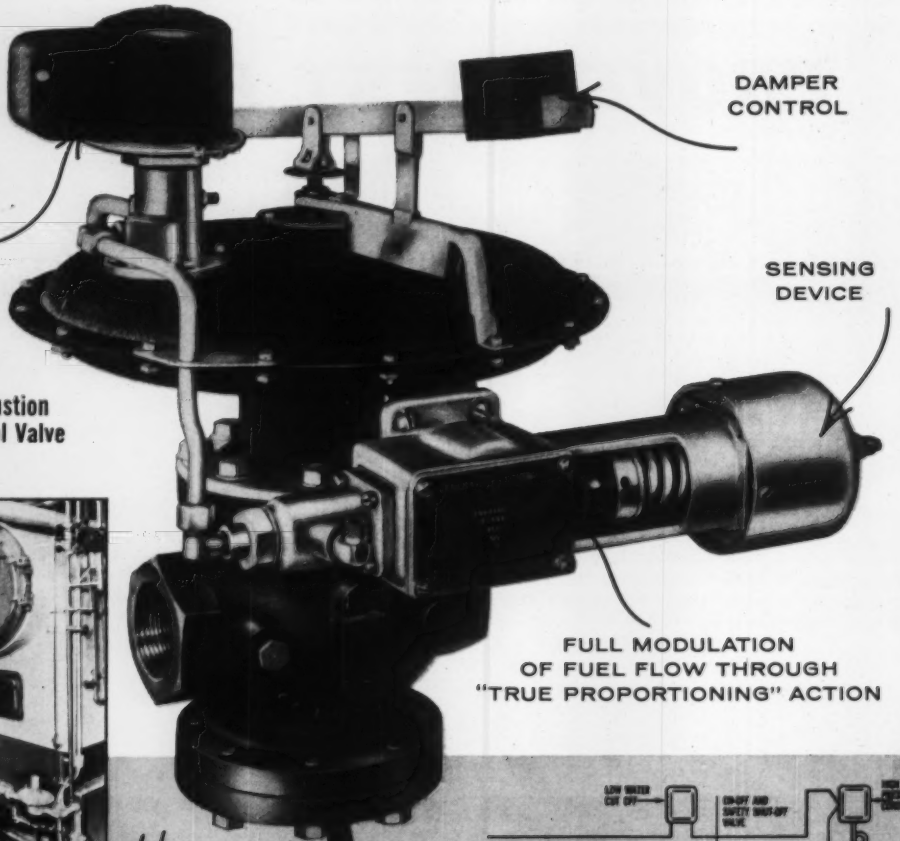
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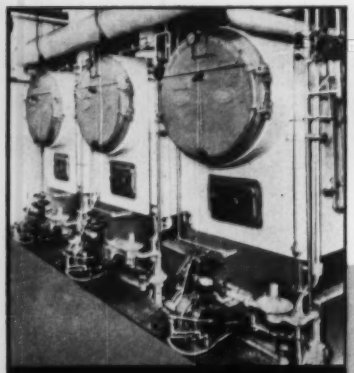
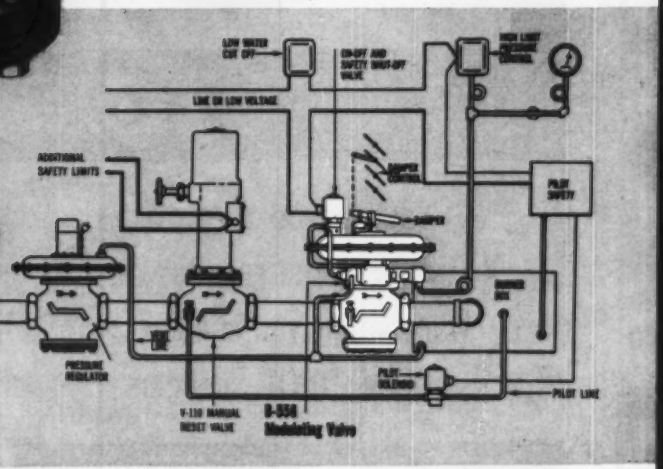
SENSING DEVICE
B-55G Combustion Control Valve
FULL MODULATION OF FUEL FLOW THROUGH "TRUE PROPORTIONING" ACTION



Note the clean, simplified arrangement of this B-55G installation—**one** valve doing the work of **four!**

*Here's all you need for a complete Control System*

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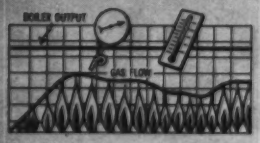
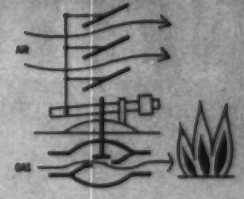
## CONTROL



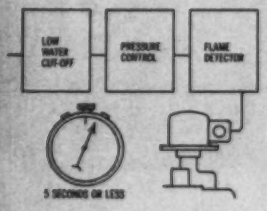

**Full modulation** provides steady boiler pressure (or furnace temperature) in response to changes in load. Variable speed of response eliminates "hunting" action. Valve moves slowly for slight changes, more rapidly for greater changes.

## EFFICIENCY



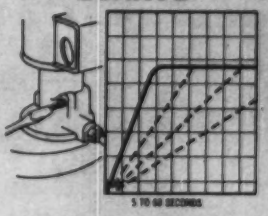

Proper fuel/air mixture is maintained throughout full throttling range of the valve. This means efficient, fuel-saving combustion for ALL firing conditions.

## SAFETY



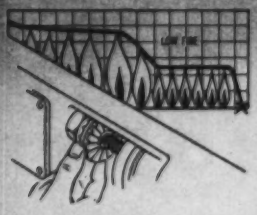

Quick-closing safety shut-off responds readily to high limit controls. Magnetic pilot valve overrides proportioning action—provides fast, positive shut-down.

## DEPENDABLE STARTS




Opening speed is adjustable for best possible ignition and pick-up. You get safe, sure starts without roll-out explosions!

## NO PUFF-BACK




Low-Fire position is adjustable for boiler "idling" at safe minimum flame. Quick closing action prevents flame flutter and dangerous puff-backs.

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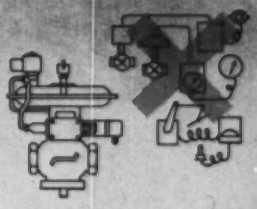

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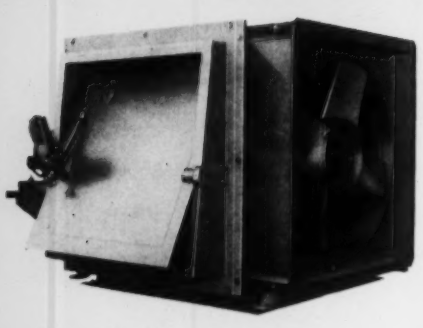
showing inner assembly partially withdrawn.



Discharge end of Inducer showing optional barometric damper.

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Cost Less
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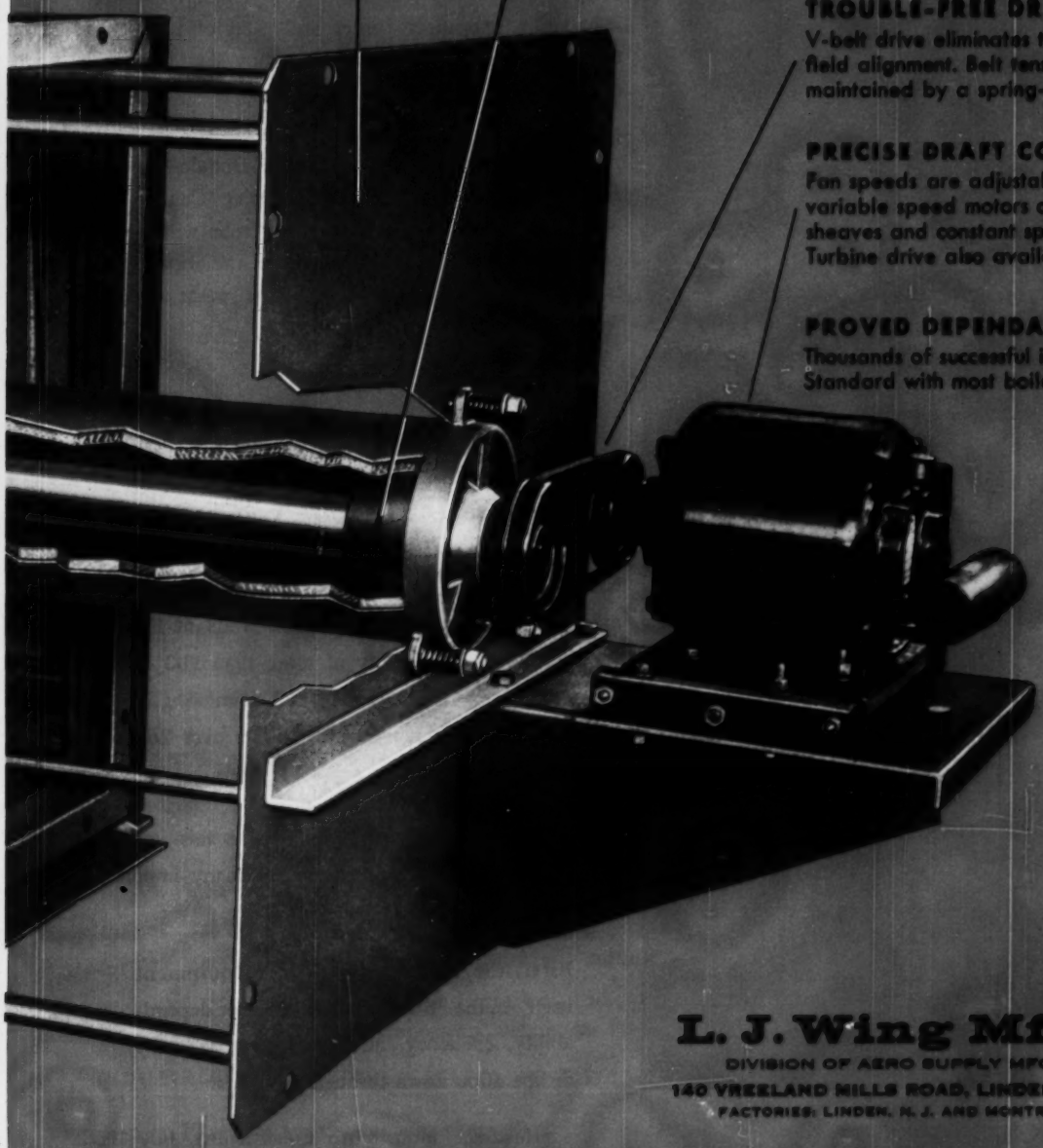
Sealed type bearings require no lubrication. Unique Wing design draws cooling air through insulated shaft tube protecting bearings from flue gas temperatures, even as high as 750°F.

**QUIET OPERATION**
Ideally suited for use in schools, churches, hospitals, etc.

**TROUBLE-FREE DRIVE**
V-belt drive eliminates the need for field alignment. Belt tension is automatically maintained by a spring-loaded base.

**PRECISE DRAFT CONTROL**
Fan speeds are adjustable with either variable speed motors or with adjustable pitch sheaves and constant speed motors. Turbine drive also available.

**PROVED DEPENDABILITY**
Thousands of successful installations. Standard with most boiler manufacturers.

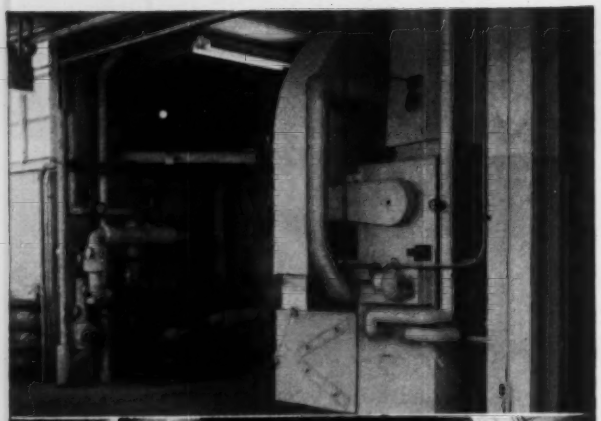


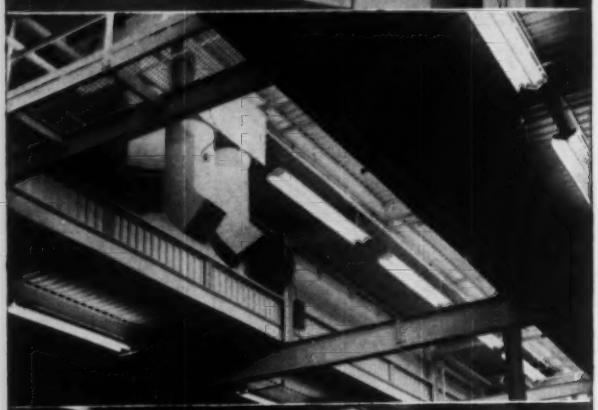
For detailed information on how Wing Draft Inducers can give you lowered installed costs, lower fuel costs, and reliable operation, write for Bulletin I-58.

# L. J. Wing Mfg. Co.

DIVISION OF AERO SUPPLY MFG. CO. INC.
140 VREELAND MILLS ROAD, LINDEN, NEW JERSEY
FACTORIES: LINDEN, N. J. AND MONTREAL, CANADA

OTHER WING PRODUCTS: Unit Heaters, Fresh Air Supply Heaters, Fans, Turbine and Motor Blowers, Auxiliary Turbines.





At top left is one of many "Buffalo" Central Station Air Conditioning Cabinets installed in Adhesive Plaster Mill of new Johnson & Johnson plant. These versatile units can be used for cooling and dehumidifying, heating and humidifying and/or air cleaning.

Second photo shows vertically suspended down-flow "Buffalo" Lowboy Heating Units used in Shipping Center. Ideal for heating large floor areas, these quiet, highly efficient units conserve valuable storage or production space.

At extreme upper left of third photo is a quiet, compact, efficient "Buffalo" Type "NV" Propeller Fan installation in Baby Products Plant. These economical "package" units for either direct or V-belt drive are shipped completely assembled, ready for quick, easy installation. At upper center and right of photo are two more "Buffalo" suspended Lowboy Heating Units, described above.

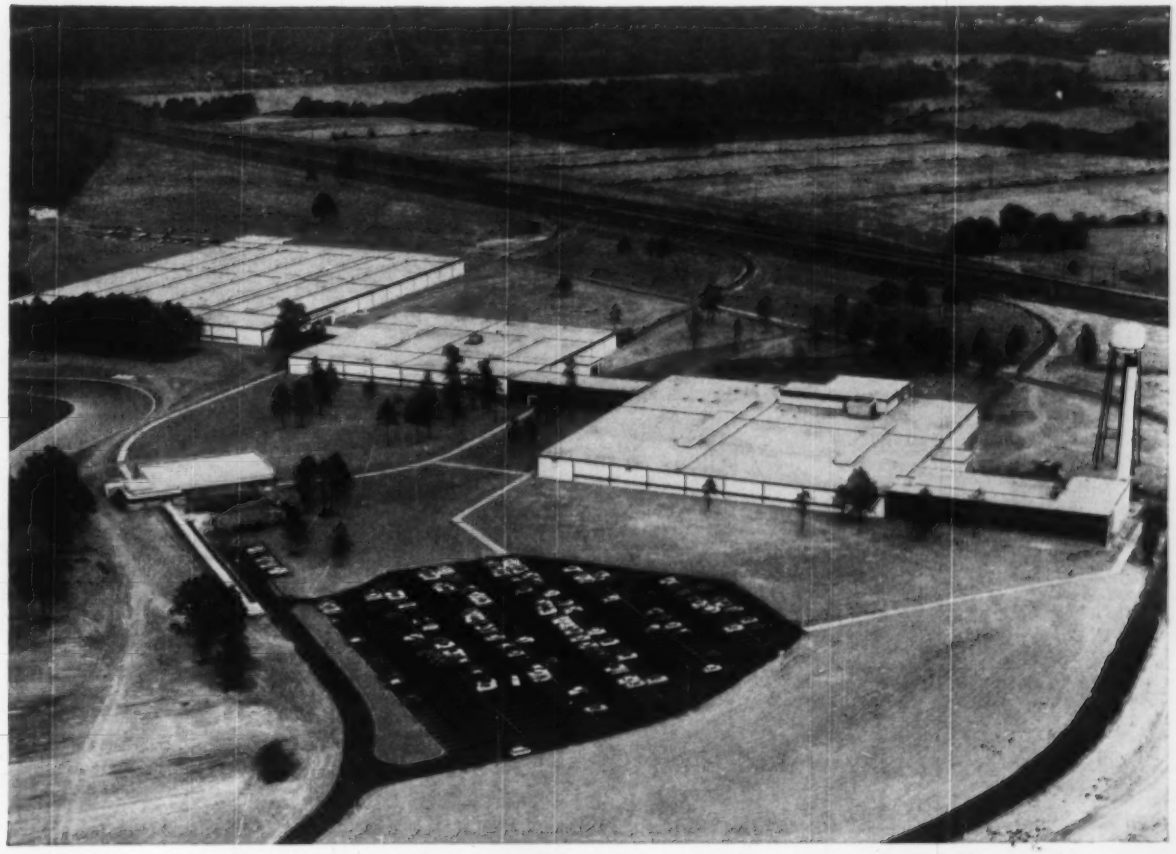
At lower left is one of the numerous "Buffalo" Breezo-Fin Unit Heaters installed in Shipping Center. The heater element is a one-piece copper tube with square copper fins, spaced to give maximum radiation. There is no possibility of inside leakage. The motor mount is welded one-piece construction.

## COMPLEX PLANT HEATING

The sheer statistics of this new Johnson & Johnson plant are impressive. Located on a 300 acre tract, its 635,000 sq. ft. of floor space extend for nearly half a mile. It uses more than 1,000,000 watts of lighting, sufficient for a community of more than 900 homes. The complexity of its heating and ventilating system is indicated by the fact that it utilizes over 26 miles of piping.

"Buffalo" equipment was specified for this complex heating and air conditioning job for many important reasons:

> First, the high quality of the equipment itself . . . the "Buffalo" reputation for dependability, efficiency, advance-design, economy of operation down through the years.



*Johnson & Johnson's Newest: World's Largest Surgical Dressings Plant at North Brunswick, N. J.*

*Engineers and Builders: Walter Kidde Constructors, Inc.,*
*Mechanical Contractors: Richardson Engineering Co.,*
*Sheet Metal Contractors: Middlesex Sheet Metal Co., Inc.*

## & AIR CONDITIONING PROBLEM SOLVED BY "BUFFALO" EQUIPMENT

Second, the **completeness** of the "Buffalo" line of heating and ventilating equipment . . . the wide variety of types, models and capacities to fit every possible application need. In all, "Buffalo" products quietly and efficiently handle a total of 928,000 CFM and 53,167,000 BTU/HR in this ultra-modern plant.

Third, the "Buffalo" record of more than 81 years of engineering experience, combined with modern-as-tomorrow design.

These are the sound reasons why "Buffalo" equipment was specified for the new Johnson & Johnson plant. They add up to very sound reasons for **you** to specify "Buffalo" equipment. When you plan **your** next plant heating and/or ventilating installation, be sure to call on "Buffalo". Contact your nearest "Buffalo" Engineering Representative, or write us direct for full information.

*A Vital Component of Every "Buffalo" Product is the "Q" Factor — the Built-in QUALITY Which Provides Trouble-Free Satisfaction and Long Life.*

**BUFFALO FORGE COMPANY**

**171 Mortimer St. • Buffalo, N. Y.**

Canadian Blower & Forge Co., Ltd. • Kitchener, Ont.

Sales Representatives in All Principal Cities

INDUSTRIAL EXHAUSTERS BELTED VENT SETS PROPELLER FANS "E" BLOWERS-EXHAUSTERS

# SOMETHING SPECIAL

Because all copper tubing looks more or less alike, ordering by brand name is your greatest insurance in getting that SOMETHING SPECIAL in *consistent quality*. Remember, Reading Copper Tube and Brass Tube are made by specialists whose continuing research, wholely integrated plants, expert personnel and years of experience are concentrated on the making of these particular products. From the processing of raw copper in *its own refinery* to the storage of the finished product in its strategically located depots, Reading protects the quality of its output in a manner impossible to achieve in any other way.

That SOMETHING SPECIAL that goes to you with every inch of Reading Tube insures your peace of mind and your customer good will and helps make you enjoy doing business.

***Specify READING Copper Tube;***

**it assures you *extra* value without costing you an *extra* penny!**

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

## READING TUBE CORPORATION

**Empire State Building, New York 1, N. Y. • Plant: Reading, Pa.**

***Distribution Depots:***

**READING, PA.**
**ATLANTA, GA.** 690 Murphy Ave. S.W., Unit 5, Bldg. B
**WOODSIDE, L. I., N.Y.** 57-17 Northern Blvd.
**OAKLAND, CALIF.** 410 Hegenberger Rd.
**PHILADELPHIA, PA.** 921 Penn St.
**LOS ANGELES, CALIF.** 120 No. Santa Fe Ave.
**CHICAGO, ILL.** 305 W. 31st. St.
**DENVER, COLO.** 2845 Walnut St.
**CLEVELAND, OHIO** 4615 Perkins Ave.
**HOUSTON, TEXAS** 1121 Rothwell St.
**DALLAS, TEXAS** 9000 Sovereign Row Brook Hollow Industrial District

***Sold Through Wholesalers Only***

# FREE! CADDY-WRENCH

## from June 1 to August 1 with the purchase of any cylinder of genetron® 22

**It's a wrench!** Fits "Genetron" cylinder valve stems and valve outlet caps—also fits stems of compressor service valves, soldering gas cylinders, etc.

Comfortable finger grips

¼" tool steel, smooth plated finish

**It's a carrying tool!** Fits bonnet hole on small "Genetron" cylinders

**Here's a tool** you've never seen before—specially designed for the service engineer by General Chemical. It's a combination carrying tool and wrench. We call it a "Caddy-Wrench." And, like the "Jug-a-Lug" which we created for you two years ago, this is a tool that's really helpful, really useful.

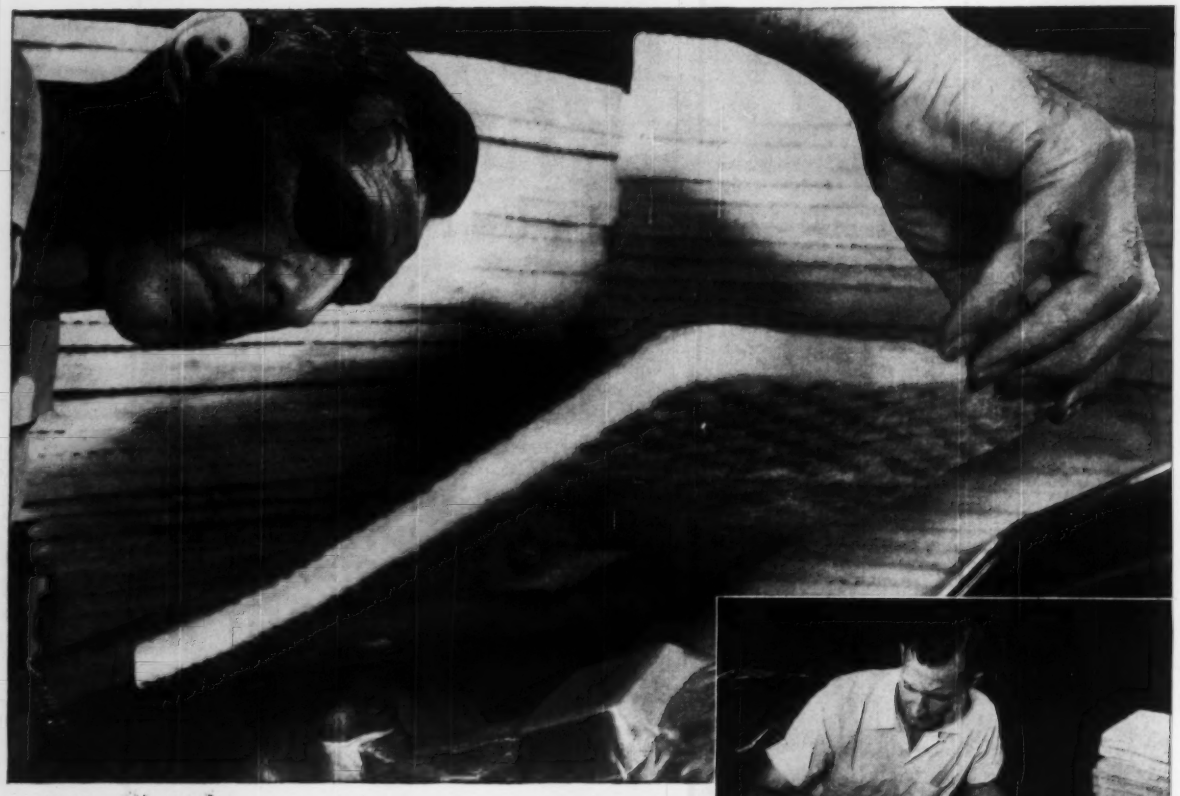
**Many uses!** As a carrying tool, the "Caddy-Wrench" makes it easy to carry small size cylinders by the hood. *No more cuts, strains and finger injuries!* And as a wrench, it's designed to fit "Genetron" cylinder valve stems and valve outlet caps, also stems of compressor service valves, soldering gas cylinders, etc. *No more adjusting wrenches or using different tools, once you have this all-purpose cylinder wrench and carrying tool!* Made of quarter-inch solid tool steel, it's strong, sturdy, won't crack, bend or break. And the smooth plated finish makes it a pleasure to use. Be sure you get *your* "Caddy-Wrench"! *Here's the only way to get one:*

**SEE YOUR WHOLESALER! When you buy any size cylinder of "Genetron" 22—between June 1 and August 1 only—your wholesaler will be glad to give you your "Caddy-Wrench" . . . free!**

Allied Chemical

**GENERAL CHEMICAL DIVISION**

40 Rector Street, New York 6, New York



Pittsburgh Superfine Fiber Glass Insulation is positioned over an aluminum liner in the manufacturing of Stewart-Warner's Instant Heat Conditionaire. Laboratory tests showed that Superfine would last for the life of the heater.

Plastic jacket is fitted over Superfine Insulation. Insulation pads measure 10⅛" x 24⅛" and are ¾" thick. Superfine deadens all noise and vibration of heater motor, fan and exhaust.

# Pittsburgh Superfine insulates

## Stewart-Warner's Instant Heat Conditionaires

The South Wind Division of Stewart-Warner Corporation, Indianapolis, Ind. has developed for Chrysler Corporation the new gasoline-burning Instant Heat Conditionaire which provides instant heat in cold weather for the Chrysler automobile. The Instant Heat Conditionaire is the fastest automobile heater in history.

On the recommendation of Chrysler engineers, Pittsburgh Superfine Fiber Glass Insulation is used in the heater to eliminate all vibration and noise from the engine, fan and exhaust. In addition, the Superfine Insulation must withstand the 300° to 350° F temperatures developed by the heater.

At the conclusion of the 1200-hour test run on the Instant Heat Conditionaire (an equivalent of five years' normal operation), the Pittsburgh Superfine Fiber Glass Insulation showed no appreciable wear or need of servicing. It will last throughout the life of the heater.

### Can Pittsburgh Superfine Help You?

Wherever noise or vibration, heat or cold present a manufacturing problem for you, Pittsburgh Superfine Fiber Glass Insulation may be the answer. Why not try it? We will be glad to help you with technical advice. Contact your nearest PPG Sales Office or write us direct. *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

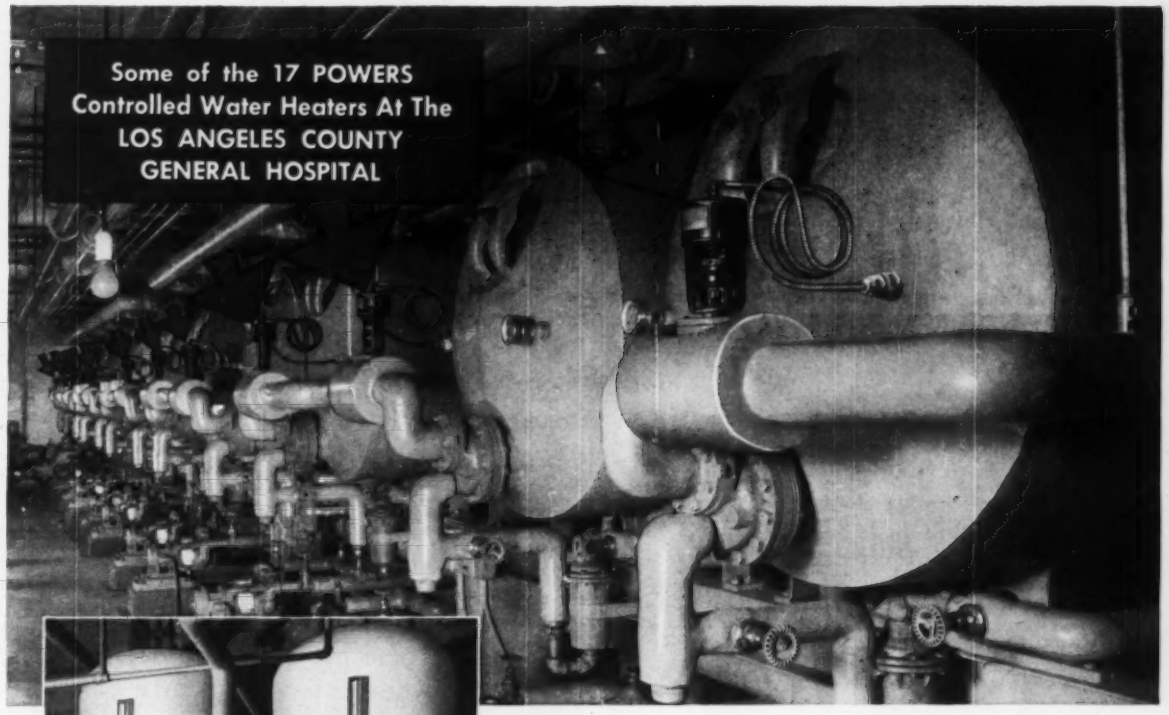
**PITTSBURGH SUPERFINE IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY**

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St. Louis

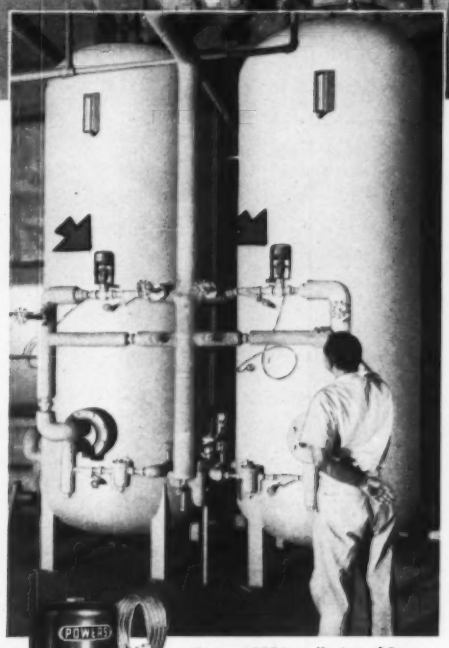
75th ANNIVERSARY 1883–1958 PPG

SYMBOL OF SERVICE FOR SEVENTY-FIVE YEARS

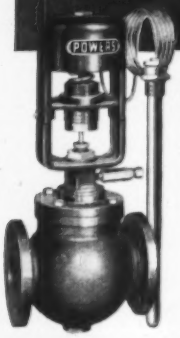
PITTSBURGH PLATE GLASS COMPANY

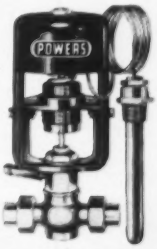



In 1933 Howe Bros., Contractors, installed 15 Powers Regulators here. All are still in operation, only 11 are shown in photo above.



Above: 1955 installation of Powers Controlled Water Heaters in Contagious Disease building. Contractor: E. Willardson Company.




POWERS No. 11 Self-Operating TEMPERATURE REGULATORS
Give Better Control • Last Longer • Save More Money

(c48)

## "after 25 years of good service POWERS No. 11 Self-Operating TEMPERATURE REGULATORS are still giving dependable control"

Reports Mr. Louis J. Koch, Senior Master Mechanic

Performance records like this are not unusual with Powers regulators. With today's high cost of maintenance Powers time proven QUALITY controls are a more profitable investment than ever before.

**More POWER$ to You**—when you want thermostatic control for water heaters, heat exchangers, heating and air conditioning systems or processes.

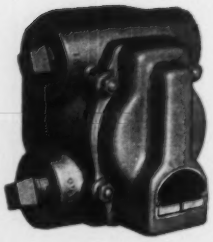
**Automatic control pays big dividends**... *IF* you have the right type of control and proper size valves for your requirements. Make sure, call POWER$ nearest office for help with your problems.

**THE POWERS REGULATOR COMPANY**

SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

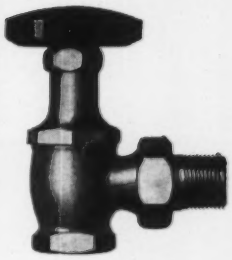
*Over 60 years of Automatic Temperature and Humidity Control*

STEAM UNIT HEATER VENTS



FLOAT & THERMOSTATIC TRAPS

"Y" STRAINERS



SUPPLY VALVES

# HOFFMAN

# Steam Specialties

MAIN VENTS

TEMPERATURE REGULATORS

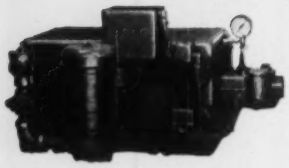
A COMPLETE QUALITY LINE . . .

. . . A SINGLE SOURCE OF SUPPLY

For either one-pipe or two-pipe residential or industrial systems there's a Hoffman Trap, Valve, Pump or other specialty designed to give you better control of every requirement.

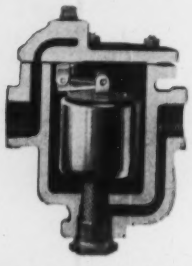
Each Hoffman product is distinguished by exclusive features that assure customer satisfaction and long, trouble-free service. This complete, tested, quality line is backed by a dependable, single source of supply and responsibility.

Write for complete catalog.

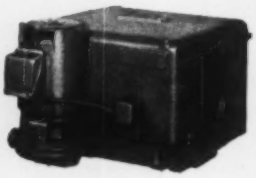


VACUUM PUMPS

PRESSURE REDUCING VALVES

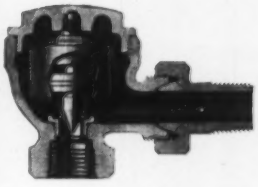


INVERTED BUCKET TRAPS



CONDENSATION PUMPS

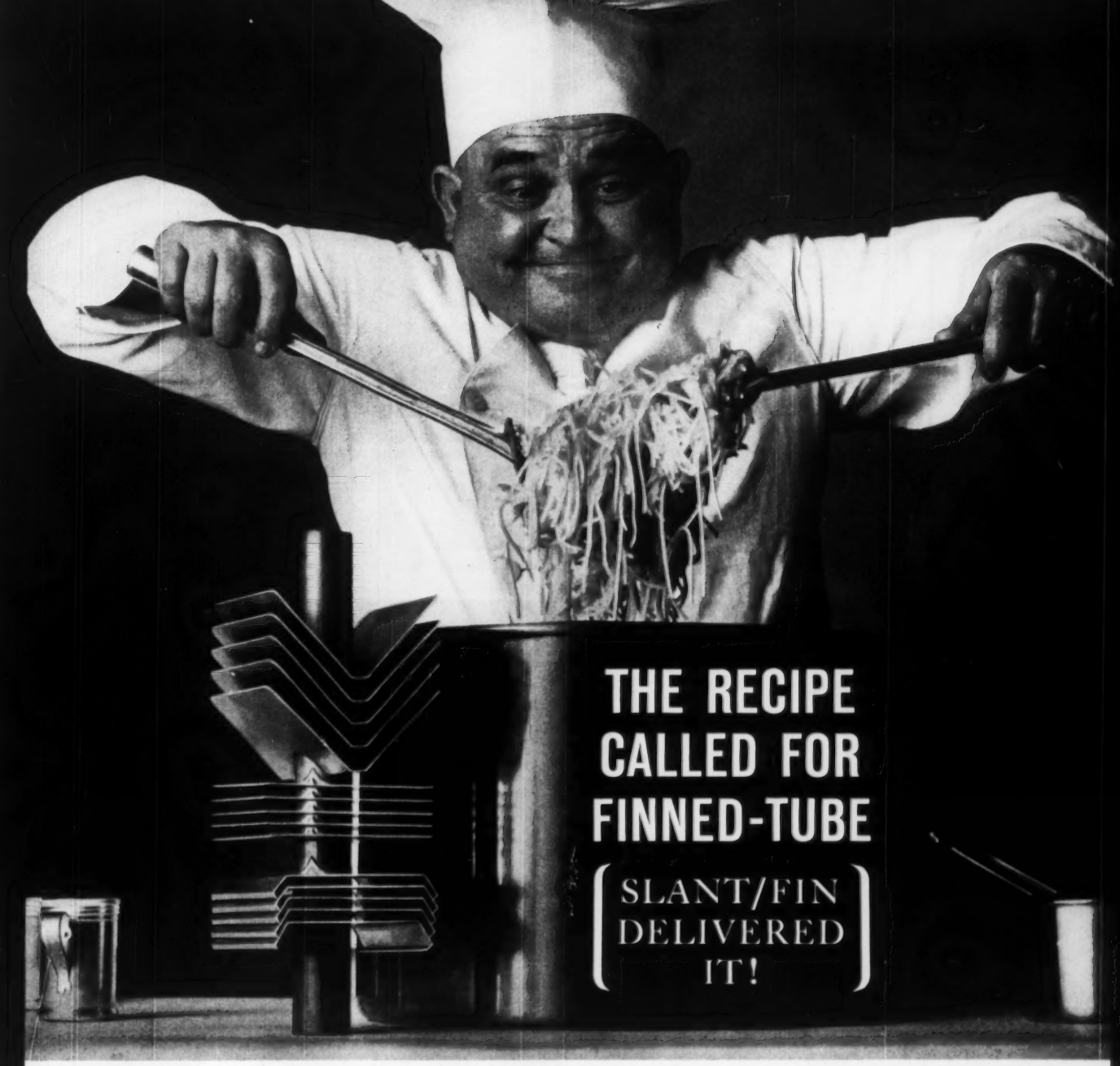
VACUUM BREAKER



THERMOSTATIC TRAPS

**HOFFMAN SPECIALTY MFG. CORP.** 1700 West 10th Street, Indianapolis 7, Indiana

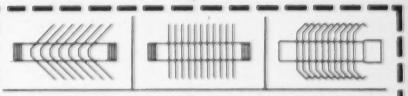
SOLD ONLY THROUGH LEADING WHOLESALERS OF PLUMBING AND HEATING EQUIPMENT



# THE RECIPE CALLED FOR FINNED-TUBE

## [SLANT/FIN DELIVERED IT!]

Recently, Slant/Fin designed and manufactured a special finned-tube element for use in a new spaghetti manufacturing process. We're told it's been responsible for a whole new flavor quality in a leading brand name product. Although a somewhat unusual application, it is by no means an uncommon request. ■ In recent years we have designed and manufactured extended-surface tubing for many special industrial requirements. Today Slant/Fin products are in use on land, sea and in the air. For example: two continuous miles of finned-tube provide accurate temperature control for a textile drying process; all-copper finned-tube heats modern ferry boats; lightweight aluminum finned-tube provides passenger comfort in executive aircraft; and Slant/Fin designed stainless steel finned-tube is specified for atomic energy installations. ■ The reason so many designers and engineers consult Slant/Fin is that Slant/Fin's manufacturing processes are completely flexible. Slant/Fin products are design-engineered to fully exploit the physical and structural properties of the materials employed. They are offered in three basic fin shapes: the V-shape, the modified V-shape and the square-finned "SQ" series. ■ If you are considering any process or system that calls for finned-tube fabricated from unusual metals or metal combinations, why not submit your requirements to us today? It's easily done — use this coupon or write in detail to the Slant/Fin Engineering Division.



Gentlemen — I am interested in special process applications of finned pipe for use in:

_____

_____

Please have a representative contact me.

Name_____

Title_____

Firm_____

Address_____

City_____ State_____

**Slant/Fin**

RADIATOR CORP., ENGINEERING DIVISION
87-49G 130th Street, Richmond Hill 18, N. Y.

# *Always Stronger* Than They Need Be!

MIDWEST

WELDING FITTINGS

Below are photographs of two of the many tests that have been made of Midwest Welding Fittings. The results are *always* the same . . . the seamless pipe to which the fittings are welded invariably bursts. There is *never* any sign of fitting failure or weakness.

There's good reason for this. We make elbows and tees of inherently stronger metal . . . the Midwest exclusive method of manufacture enables us to maintain greater minimum wall thickness, and to reinforce the fittings at points of greatest stress. For the many other advantages of Midwest Fittings, ask your Midwest distributor or write us for Catalog 54.


**MIDWEST PIPING COMPANY, INC.**

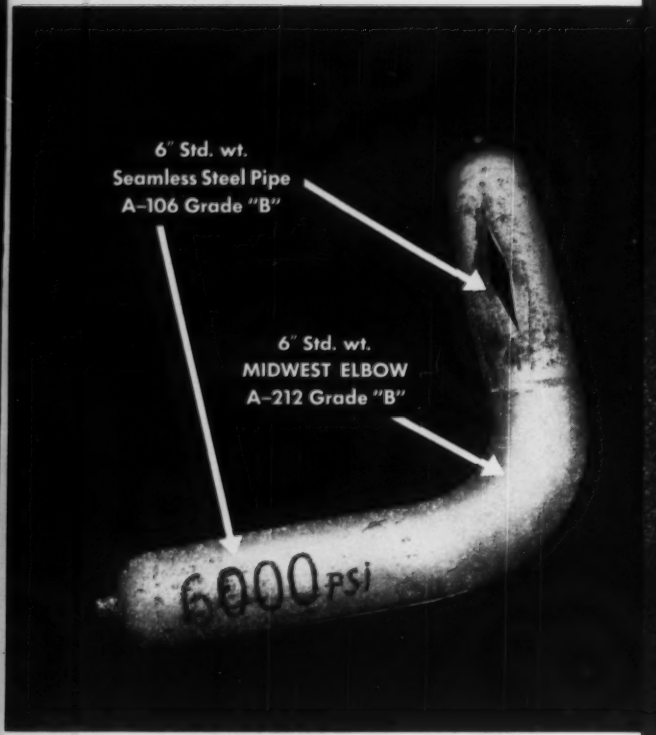
**Main Office: P.O. Box 433, St. Louis 3, Mo.**

***PLANTS: ST. LOUIS, CLIFTON, N. J. and LOS ANGELES***

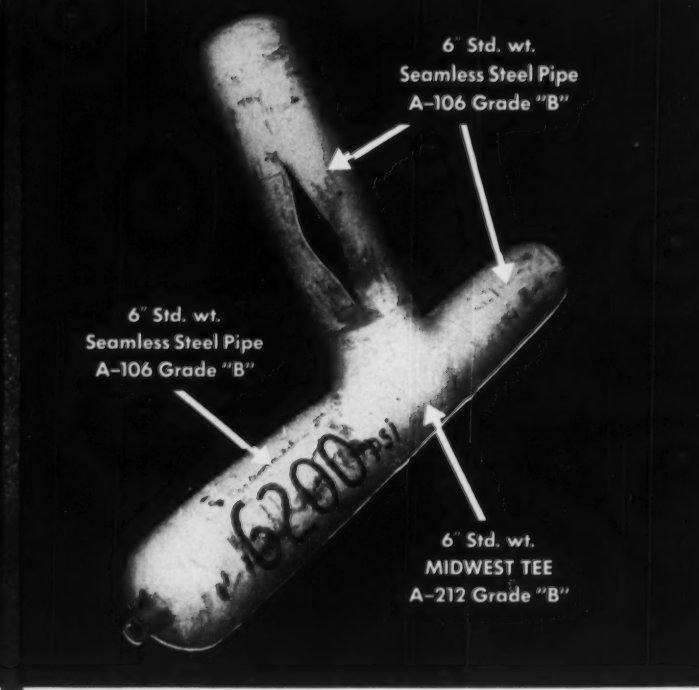
SALES OFFICES:

ASHEVILLE (BOX 441, SKYLAND, N. C.) • ATLANTA 9—72 ELEVENTH ST. N. E. • BOSTON 27—426 FIRST ST. • CHICAGO 3—79 WEST MONROE ST. • CLEVELAND 1 —616 ST. CLAIR AVE. • HOUSTON 2—1213 CAPITOL AVE. • LOS ANGELES 33—520 ANDERSON ST. • MIAMI 34—2103 LE JEUNE RD. • NEW YORK 7—50 CHURCH ST. • ONEIDA, N.Y.—282 NORTH MAIN ST. • SAN FRANCISCO 11—420 MARKET ST.

*STOCKING DISTRIBUTORS IN PRINCIPAL CITIES*


Typical bursting test of stock Midwest Welding Elbow. As is always the case, failure occurred in the seamless pipe while the elbow was undamaged. Bursting pressure was 6000 psi . . . considerably above the required code minimum for seamless pipe. (Minimum allowable bursting pressure for 6" standard weight A-106 Grade B seamless steel pipe is 4438 psi.)




Bursting test of Midwest Welding Tee taken at random from stock. As always, the failure occurred in the seamless pipe and not in the fitting. The non-shock internal bursting pressure of 6200 psi is well above the code minimum for seamless pipe. (Minimum allowable bursting pressure for 6" standard weight A-106 Grade B seamless steel pipe is 4438 psi.)

7761

MIDWEST **WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS**

# REASONS WHY ENGINEERS CHOOSE "BUFFALO" PUMPS

Let's think of pumps in terms of hard service on the job — and the reasons why "Buffalo" Pumps deliver maximum efficiency with minimum maintenance for years and years of such service.
Note these rugged construction features of "Buffalo" Full Ball Bearing Single Suction Pumps:

**1.** Sturdy cast iron bearing stand and casing mounting ring. These components are interchangeable on all size pumps up to and including No. 3. Engineers like this feature, since they often effect economies by standardizing on one line of pumps with varying capacities.

**2.** Easily-renewable bronze wearing rings protect casing from wear.

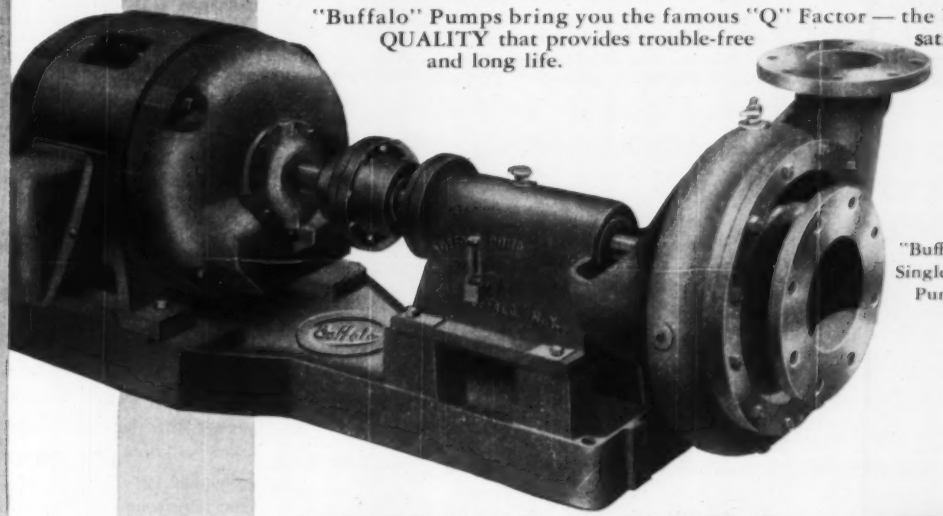
**3.** High efficiency bronze impeller. Enclosed type has liberal openings to handle abrasive solids. Open type, without wearing rings, is optional.

**4.** Oversize ball bearings running in oil provide rigid support for shaft and impeller.

Add to these the heavy cast iron frame, oversize shaft, extra-deep stuffing box, long-wearing gland with packing furnished — and you have a total of eight superior engineering features built into every "Buffalo" Single Suction Pump.

These plus many more high quality "Buffalo" components provide the sound reasons why engineers look to "Buffalo" Pumps for a long life of efficient, dependable, economical service. For your next heavy-duty pumping job, contact your nearby "Buffalo" Engineering Representative. He will be glad to work with you and help in every way. Or, write us direct for Bulletin 976-E.

"Buffalo" Pumps bring you the famous "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life.



"Buffalo" Single Suction Pump

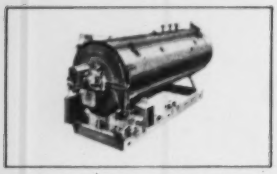
## BUFFALO PUMPS

DIVISION OF BUFFALO FORGE CO., BUFFALO, N. Y.
171 Mortimer Street • Buffalo, N. Y.
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

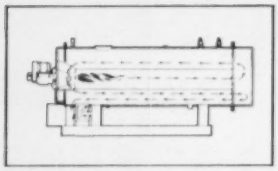
"Buffalo" PUMPS

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

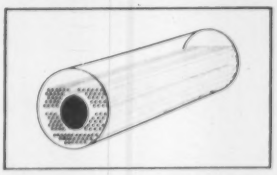
# NOW... all these "BIG BOILER" features in a compact, economical package . . .



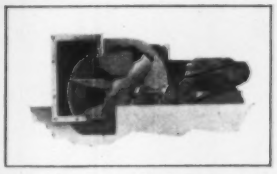
● **A complete package** including boiler burner, draft equipment, controls and all interconnecting piping and wiring. Completely assembled and factory fire-tested.



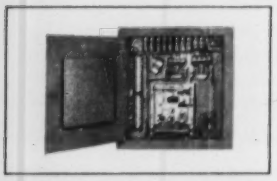
● **4-pass down-draft** design, promotes rapid water circulation. Decreasing tube volume in successive passes provides high combustion gas velocities and maximum heat transfer.



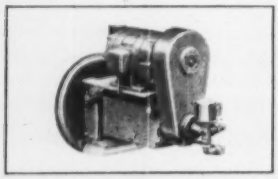
● **5 sq. ft.** of heating surface per b.h.p. Units reach conservative ratings with ease. Guaranteed thermal efficiency 80%. Stack temperatures not exceeding 125° above steam or water.



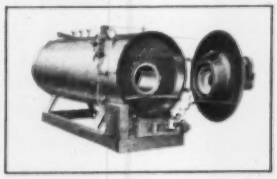
● **Induced draft** operating at relatively slow speed results in unusual quiet plus safety from danger of forcing gases out into boiler room. Negative furnace pressure also protects refractory.



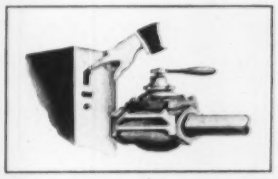
● **Fully automatic** operation firing oil, gas or both. Firing rate adjusts to demand, never overfiring wastefully, but handling sudden increases without lag. Variety of controls available.



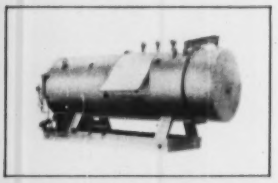
● **Superior Rotary Burners** on all sizes firing No. 4, 5 and 6 oil. Most dependable type of equipment ever devised for burning heavy oils. Burners require minimum supervision, and no lubrication.



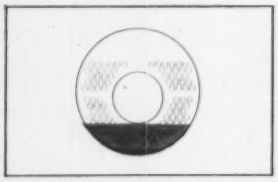
● **Hinged** front and hinged or davited rear door on all units. Doors may be opened simply without removing refractory and are simply and effectively sealed with standard asbestos rope.



● **Instantaneous fuel changeover.** Units equipped for oil and gas firing may be changed from one fuel to another quickly and simply by operating only a switch and a valve.

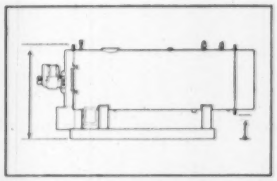


● **Completely insulated** and jacketed. Even the bottom of the boiler shell is covered with 2" insulation. No uninsulated areas for heat loss and unnecessary heating of the boiler room.

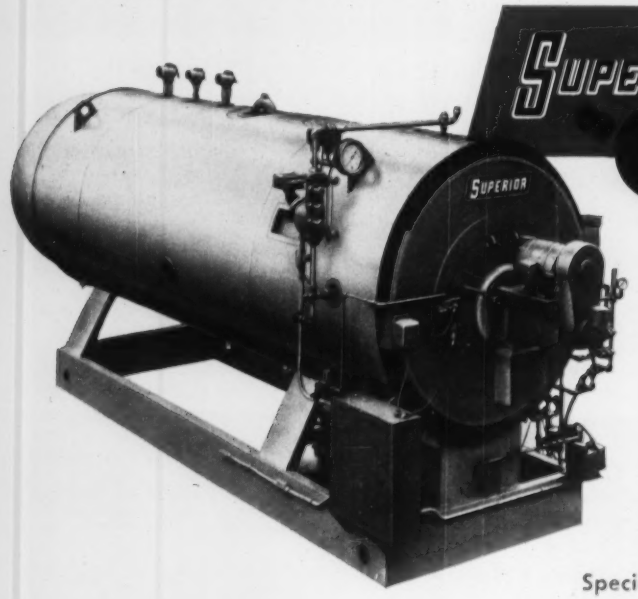


● **Down-draft design** places furnace high in shell, safely away from danger zone . . . completely eliminates bagging and blistering resulting from mud build-up in bottom of boiler.

● **Constant gas pilot** remains lit at all times, prevents accumulation of gas in the furnace which could result from even an almost undetectable leak in the gas valve.



● **Low total height** but with clearance from floor allows ample room under the shell for inspection, maintenance and installation of piping. The COMPACT is practical as well as compact.



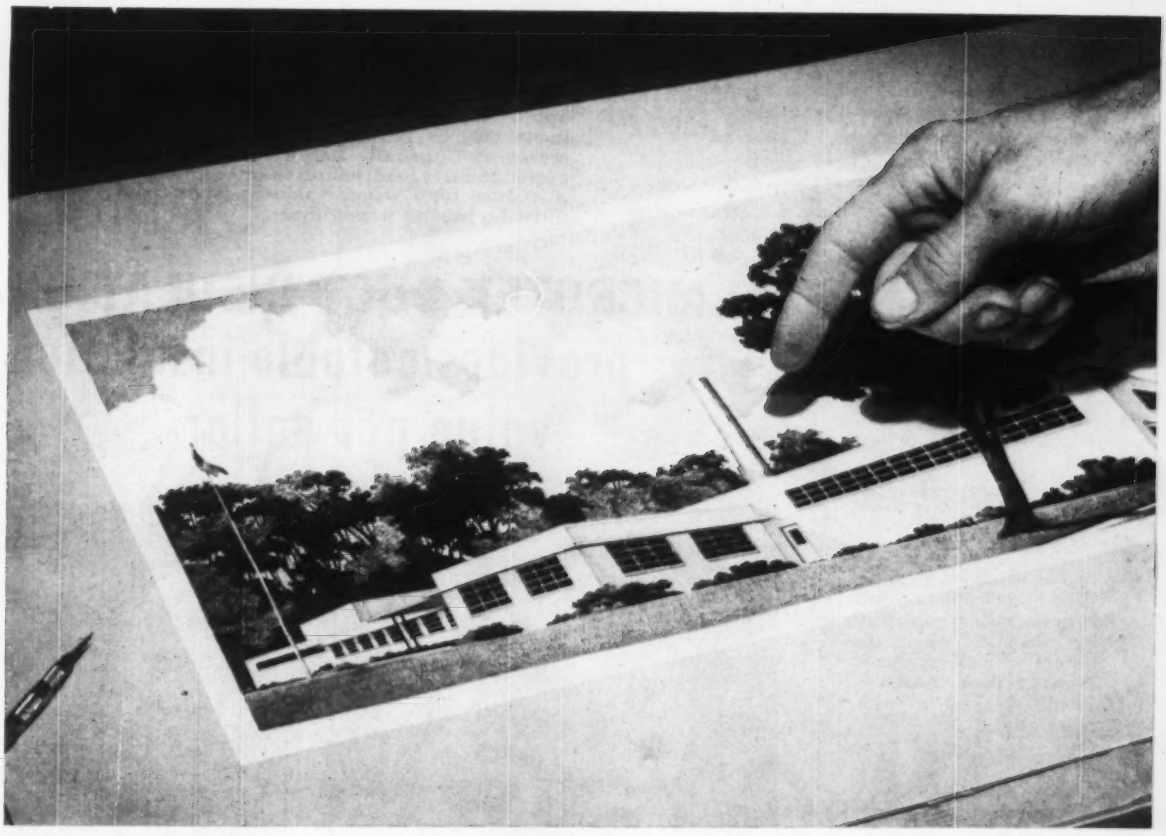

## SUPERIOR "COMPACT"

Here at last is a boiler which combines all of the most desirable features of big boiler design with an unusual degree of compactness. Ideal for installations where space is limited, it also provides an economical answer both from the standpoint of purchase and installation costs for any application having steam requirements of from 20 to 200 B.H.P.

Pressures to 250 psi, or hot water units also available. Write today for Bulletin 1004C

**SUPERIOR COMBUSTION INDUSTRIES INC.**
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

Specialists in PACKAGED BOILERS... exclusively



# "Now we can get rid of that stack"

## New Petro FORCED DRAFT burner for smaller boilers (OIL, GAS OR COMBINATION GAS-OIL)

This advanced Petro forced-draft burner is as compactly built and service-free as your home oil burner; yet it delivers some surprising extra values.

First, built into it is a complete combustion system, with forced draft air supply, fuel systems and prewired integral control panel—all assembled and tested at the factory.

Second, it eliminates the need for a high stack, yet requires no induced draft fan.

Third, a burner head of new design cures the old problem of flame pulsation, in both gas and oil firing—in either natural draft or pressurized boilers.

Finally, it is available for either light oil or gas firing—or a combination of both—with instantaneous change of fuel under either automatic or manual control.

Available as a complete burner unit for easy application to any type of boiler, from 18 to 92 bhp. Also available in a complete boiler-burner unit (with Scotch boiler) delivered at site, ready for service connections. For full description and specifications, please mail coupon.

*See Petro Catalog in Sweet's Architectural File*

**Makers of Quality Heating and Power Equipment since 1903**

PETRO

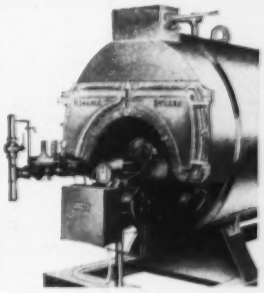
T. M. REG. U. S. PAT. OFF.

Forced draft... no stack or induced draft fan required.

No flame pulsation.

Single or dual-fuel firing.

Complete unit with Scotch boiler; or burner only for use with any type boiler.



PETRO
3234 West 106th St.
Cleveland 11, Ohio
(In Canada: 80 Ward Street, Toronto, Ontario.)

Please send me information on Petro P-240 Forced Draft Gas-Oil Burner.

Name .....

Company .....

Address .....

City ..... State .....

# NEW UNION OIL CENTER

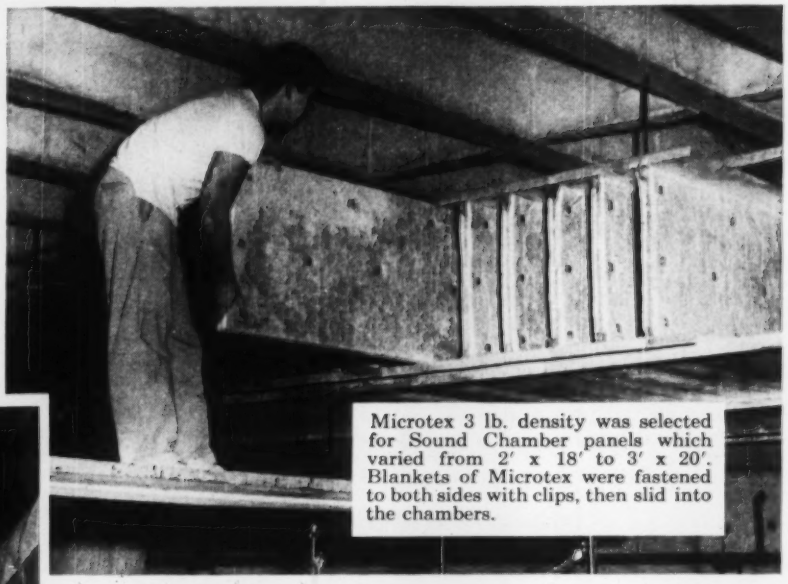
Los Angeles, California

● ACOUSTICAL PROBLEM: **Supply duct velocity 3600 ft./min. Return ducts 1200 ft./min., with 8½ lbs. of static pressure: Unusually heavy equipment required to carry load; sound chambers needed to reduce high velocity noises; labor costs must be held to a minimum.**

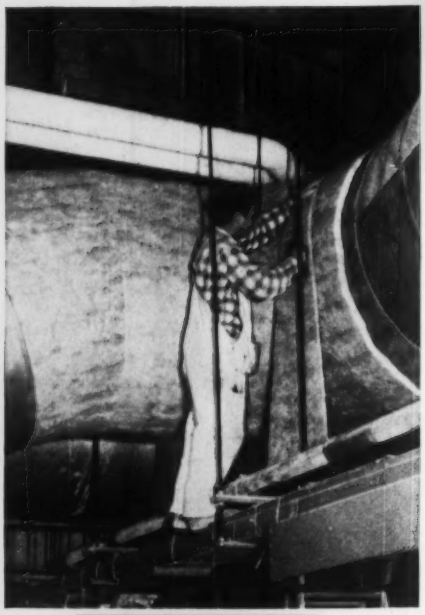
● ANSWER:

## MICROTEX DUCT INSULATION provides notable insulation value per dollar

Eight carloads of Microtex Glass Fiber Insulation used in the largest air conditioning insulation job in the history of the West Coast. *Architect:* Pereira & Luckman; *Contractor:* Del E. Webb Construction Co.



Microtex 3 lb. density was selected for Sound Chamber panels which varied from 2′ x 18′ to 3′ x 20′. Blankets of Microtex were fastened to both sides with clips, then slid into the chambers.



### Efficiency in Operation . . . Simplicity in Application

***Nearly 80% of all insulation in the Union Oil Center is Microtex***

Reason: Microtex absorbs fan and motor noises, soaks up sounds transmitted through the ducts, increases system efficiency. A low density, resilient blanket insulation, Microtex is made from fine glass fibers, bonded together, creating countless microscopic dead air cells which account for its high thermal and sound absorption characteristics.

For full information call or write any L·O·F Glass Fibers' sales office or distributor.

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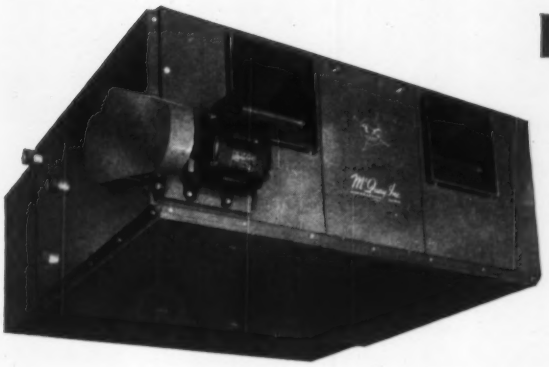
# you get MORE and MORE to choose from with

McQuay Seasonmaster central station air conditioners give you more of everything you want, more of everything you need. There is more inherent quality—more dependability—more rugged construction—more flexibility in location of coil connections and air openings—so necessary to that kind of satisfaction that only McQuay Seasonmaster provides. McQuay also gives you more to choose from, with 16 models in either horizontal or vertical type. Add to this the most complete combinations of heating and cooling coils—water, steam or direct expansion—all with the famous McQuay Ripple-Fin construction, and the wide range of accessories, and you have the most universal line of central station air conditioners in the industry. Yes, you really get more—and more to choose from with McQuay Seasonmaster central station air conditioners. For complete information, contact the McQuay representative in or near your city or write McQuay, Inc., 1601 Broadway St. N. E., Minneapolis 13, Minn.

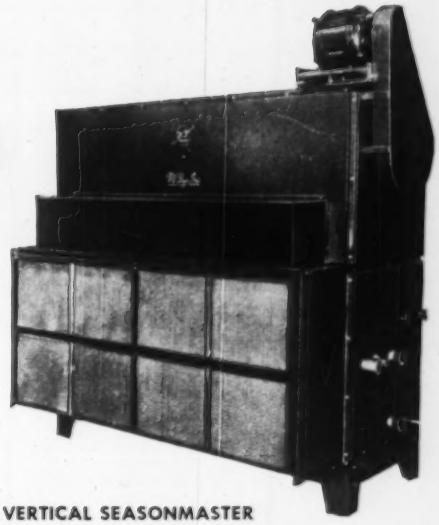
McQuay

# SEASONMASTER

central station air conditioners



TV Means Quality



**McQUAY HORIZONTAL SEASONMASTER**

*McQuay horizontal Seasonmaster*, shown above, with water coil, steam coil and "V" filter section. Removable panels permit complete accessibility for inspection or service. All Seasonmaster coils are made with the exclusive McQuay Ripple-Fin construction.

**McQUAY VERTICAL SEASONMASTER**

*McQuay vertical Seasonmaster*, shown above, with direct expansion coil, steam coil, face and by-pass, and flat filter section. Heavy gage galvanized channel framework to form a rigid structure. Sixteen sizes available in either horizontal or vertical type. C.F.M. range from 640 to 29,000.

McQuay INC.

AIR CONDITIONING
HEATING
REFRIGERATION

Mr. Ammons, Manager of the luxurious Ambassador Motel, states, "We specified SPANG Galvanized Steel Pipe for plumbing, underground sprinklers, and swimming pool, because we knew from experience it is reliable, long-lasting."

# Our choice for economy and long service: SPANG GALVANIZED STEEL PIPE

*says Mr. Gene Ammons, Manager, Ambassador Motel, Fayetteville, North Carolina*

"Because the motel business is operated on a narrow margin of profit, we have to keep extra overhead at an absolute minimum," states Mr. Ammons. "We knew that SPANG Galvanized Steel Pipe was our best guarantee against future breaks, leaking joints, corrosion."

Mr. E. L. Plummer, job contractor, also reports, "In view of this need for practical economy, SPANG Galvanized Pipe was a natural choice; it should give Ambassador at least 25 years of efficient, reliable, trouble-free service."

## GET QUALITY EVERY TIME WITH SPANG!

You can depend on SPANG Galvanized Steel Pipe for ease of handling, service, and quality. It is manufactured under strict quality-controlled methods, and your shipment is rigidly inspected to insure you top performance. For your next pipe installation make it steel pipe . . . make it SPANG. Call your SPANG Distributor; he'll be glad to help you.

**General Contractor:** Thompson Construction Co., Fayetteville, N.C.
**Plumbing & Heating Contractor:** Lennox H. Bramble Co., Fayetteville, N.C.
**SPANG Distributor:** Smith-Dozier Supply Co., Fayetteville, N.C.

**SPANG-CHALFANT**
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Offices:
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SPANG®
CW STEEL PIPE

# B&G EQUIPMENT INSTALLED FOR HEATING...SNOW MELTING ...AND DOMESTIC HOT WATER CIRCULATION IN

# INLAND STEEL BUILDING

In this outstanding building, B&G Series 1531 Pumps are used in three different applications to (1) circulate water in the first floor heating system, (2) supply hot anti-freeze solution to snow melting panels, (3) circulate chilled water and cooling tower make-up water.

These pumps feature *vertical* split case construction which permits servicing without breaking pipe connections. They have leak-proof mechanical seals of "Remite"—a diamond-hard material developed by B&G.

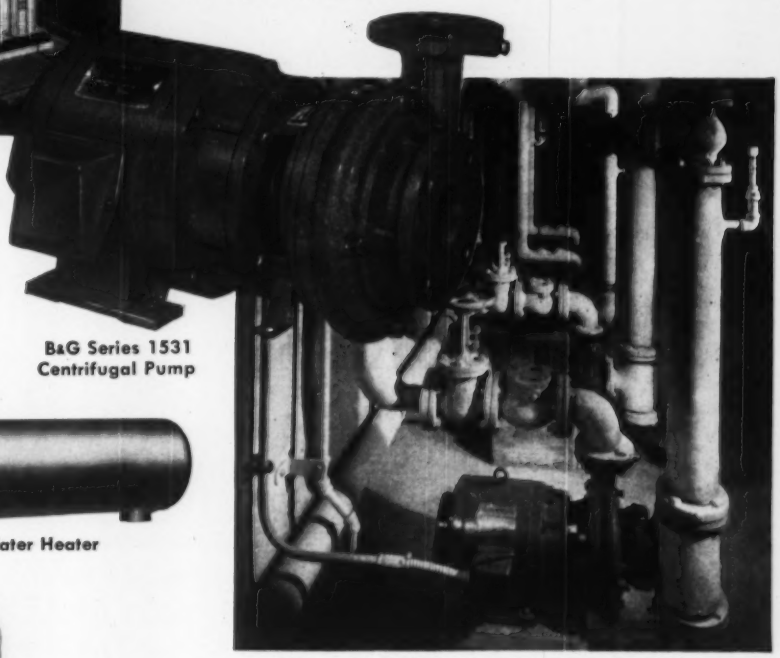
The B&G Booster used to re-circulate domestic hot water is a bronze unit—immune to the corrosive effects of continuously circulated raw water. To heat the anti-freeze solution for the snow melting panels under the sidewalks and garage ramp and for supplying hot water to the first floor heating system, two B&G "SU" steam convertors are installed.

**Inland Steel Building, Chicago, Illinois**

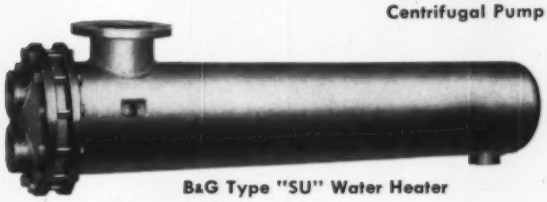
**Architects and Engineers:**
Skidmore, Owings & Merrill, Chicago.

**General Contractor:**
Turner Construction Company, Chicago.

**Mechanical Contractor:** Economy
Plumbing & Heating Company, Chicago.



**B&G Series 1531 Centrifugal Pump**



**B&G Type "SU" Water Heater**

**B&G Bronze Booster Pump**

*Battery of B&G Series 1531 Centrifugal Pumps in Inland Steel Building*

**Send for literature on these B&G Products**

**BELL & GOSSETT**
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**Dept. FI-5, Morton Grove, Illinois**

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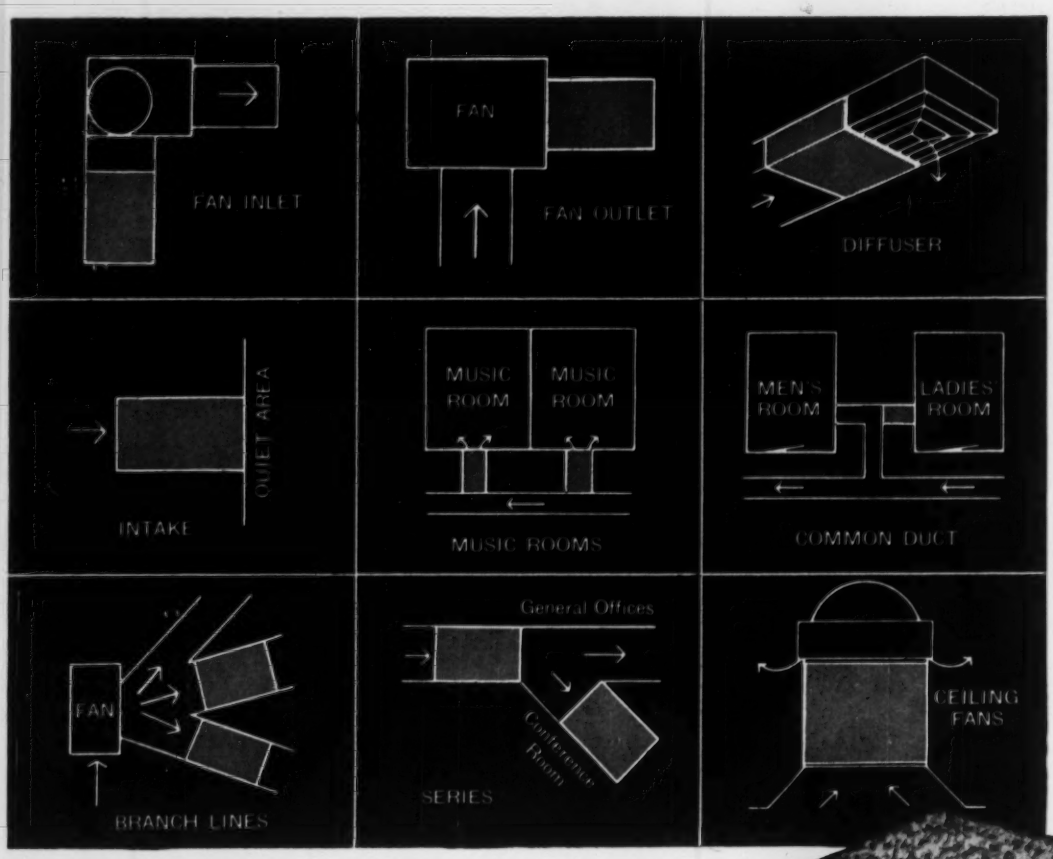
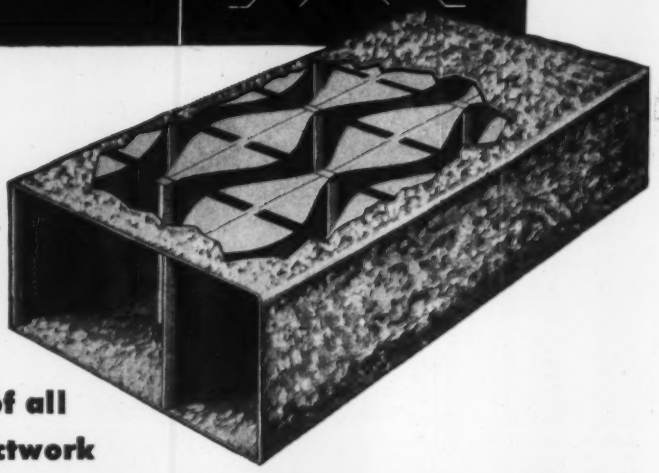



# Every Building Needs *Aircoustat*™ Sound Traps



## AIRCOUSTAT silences all noise of all frequencies traveling through ductwork

Eliminate disturbance, distraction and irritation caused by noises escaping from one area to another through ductwork.

Install AIRCOUSTAT Sound Traps. AIRCOUSTAT eliminates guesswork, wasted space and unnecessary expense of duct lining. You can guarantee your client trouble-free performance. You can estimate with complete confidence the performance of particular applications. If AIRCOUSTAT fits geometrically, it fits acoustically.

AIRCOUSTAT saves you space. Its greater effectiveness permits smaller-sized ducting. It eliminates bulky mufflers.

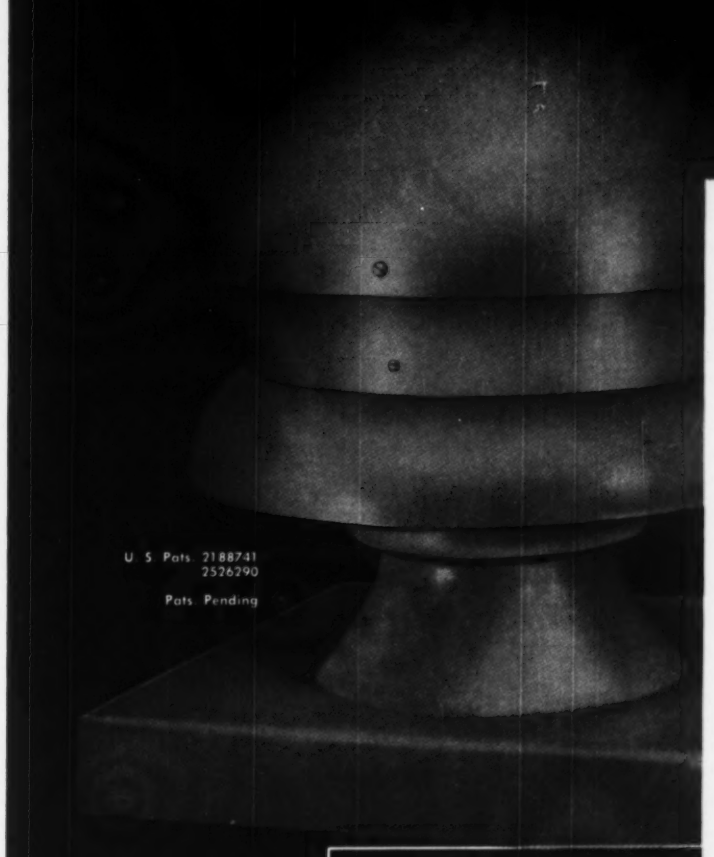
For more details, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 6207 Scott Street, Baltimore 3, Md.

KOPPERS

**INDUSTRIAL SOUND CONTROL**

***Engineered*** Products Sold with ***Service***

# new SUPER/AIR-VAN®
# in FIBERGLAS*



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## New INTEGRATED DESIGN

obsoletes all previous standards for roof exhausters.

**No important factor is neglected**

**INHERENTLY QUIET.** For the first time a power roof exhauster is *actually* constructed of a *sound absorbing and dampening material.*

**LIGHTWEIGHT! GREAT STRENGTH!** Structurally equal to steel, yet far lighter. Less subject to vibration. Much greater impact strength than aluminum or steel. Lightweight also means new economies in both shipping and installation.

**CORROSION RESISTANT.** Uneffected by salt spray, common acids, greases, etc. *Never needs painting,* permanent color—a material that gives lifetime use without maintenance.

**PATENTED SCROLL DESIGN** assures efficiency. Static pressures to 4 inches.

**MODERN LOW SILHOUETTE.** Maximum curb 4". Unit (at left) delivers 1655 CFM of free air. Height only 25".

*Write for new, detailed literature or contact one of our 60 representatives.*

AMCA Seal does not apply to units with wheels of less than 12" diameter.

**GALLAHER**

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4108 Dodge Street Omaha, Nebraska

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FRICK TRADE MARK

AT THE

# "CROSSROADS OF THE SOUTH"

## New Fulton Federal Building in Atlanta uses Frick Air Conditioning throughout.

Half a block from the famous intersection of Peachtree St. at Five Points, in historic Atlanta, is the new home of the Fulton County Federal Savings & Loan Association.

All planning was directed toward achieving the most modern and distinctive bank-office building in the South. Eight different types of domestic and foreign marble were used in the construction. The entire building is equipped with zoned year-around air conditioning.

Five Frick "ECLIPSE" compressors supply the refrigeration for chilling the water for air conditioning. Four of the compressors in a penthouse handle the cooling of the eight top floors, while the other machine, located in the basement, serves the remaining floors. The entire system is fully automatic. Mr. William M. Scurry, President, states, "Since this Frick system has been installed, it has proved highly satisfactory in every respect."

Architects: Abreau and Robeson, Inc., Atlanta, Georgia.

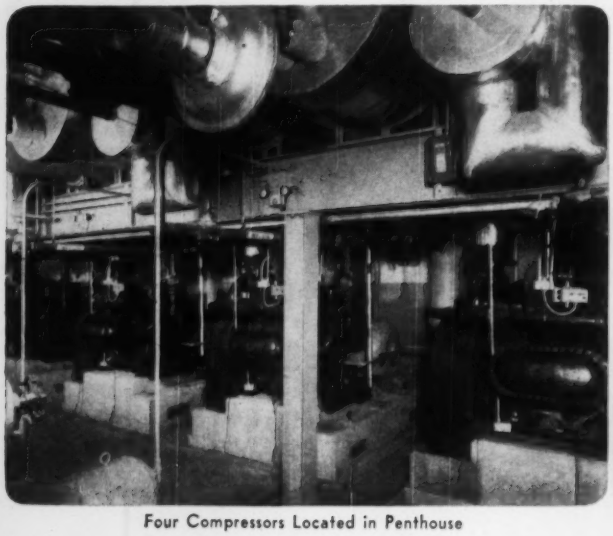
For that all-important air conditioning, ice making, quick freezing or any other refrigeration work of yours, call the nearest Frick representative. Branch Offices and Distributors are located in principal cities the world over. They have the knowledge and equipment to solve all of your cooling problems.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U. S. A.

*Our Booth at the International Heating & Air Conditioning Exposition is 309.*



Four Compressors Located in Penthouse

Air Conditioned Banking Room in Fulton Federal Savings

*never before so much*

# CONVENIENCE

*with such great*

# ECONOMY

*in air filtration!*

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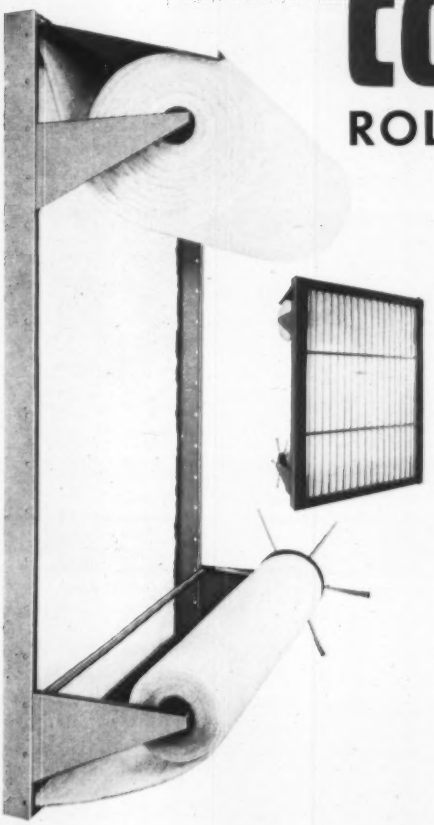
*The Amazingly Simple NEW*

# CONOMANUAL

## ROLL-AWAY TYPE AIR FILTER

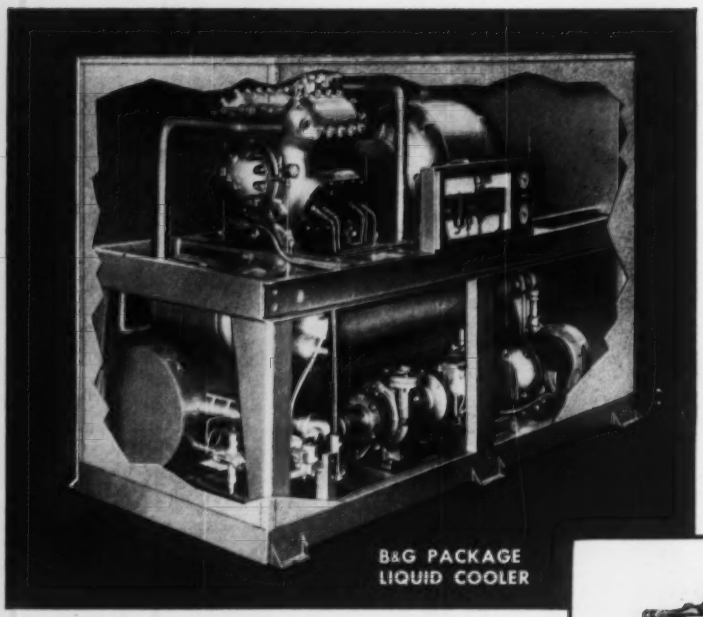


***Requires the least attention and effort of any non-automatic filter system.***

**CONOMANUAL**—the hand-operated, roll-away type, viscous impingement filter—has been designed especially for installations where initial cost limitations prevent consideration of automatic equipment, but where the convenience, economy, and cleanliness of roll-away, disposable-media filter is desired. Available for any desired capacity.

**CONOMANUAL'S** new synthetic fiber media is a ½-inch blanket reinforced with a sturdy cotton mesh to provide great tensile strength. It is moisture-, fungus-, and fire-resistant. Low resistance and unusually high dust-holding capacity extend filter life and add to the amazing economy of this filter.

Check the advantages of CONOMANUAL for use—ask for Bulletin No. 850. Contact your local Continental Representative or write direct to Continental to clear the air.

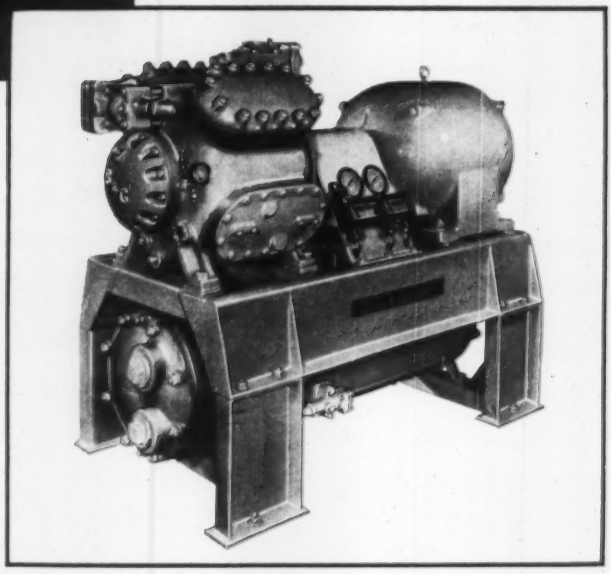


B&G PACKAGE
LIQUID COOLER

# B&G

## "PACKAGE" UNITS

## ...WITH ALL MAJOR COMPONENTS DESIGNED, BUILT AND GUARANTEED BY ONE MANUFACTURER



B&G offers a complete line of top quality air conditioning and refrigeration equipment. Many exclusive features have been designed into these products which materially reduce space requirements—improve operating economy—add to life of the equipment.

For a completely integrated and assembled water chiller, the B&G Package Liquid Cooler offers many outstanding advantages. It is equipped with B&G products throughout—the only unit of its kind with *all major components designed, built and guaranteed by one manufacturer!* With this packaged unit, costs which might otherwise be charged against the job are eliminated.

The new Condensing Unit is another "B&G" equipped product—motor, compressor and condenser are all manufactured by Bell & Gossett Company and assembled as a complete unit.

### A FULL LINE OF REFRIGERATION AND AIR CONDITIONING COMPONENTS

B&G Condenser

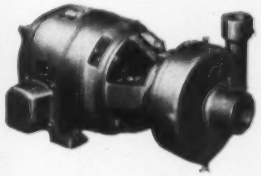
B&G Evaporater

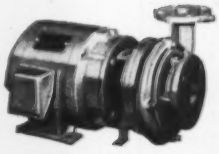
B&G Heat Exchanger

B&G Evaporators and Condensers all offer *plus* values in efficiency and rugged, long life construction. They are built to ASME Code requirements and so stamped.

When selecting pumps, B&G Series 1522 units invite your most critical comparison. Of vertical split-case design and equipped with the leak proof "Remite" Mechanical Seal, its operation is amazingly *silent!* Other B&G centrifugal pumps offer similar features for completely satisfactory performance.

B&G Series 1522 Pump





B&G Series 1531 Pump

***Send for complete file of specifications and application data on B&G Air Conditioning and Refrigeration Equipment.***

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**BELL & GOSSETT**
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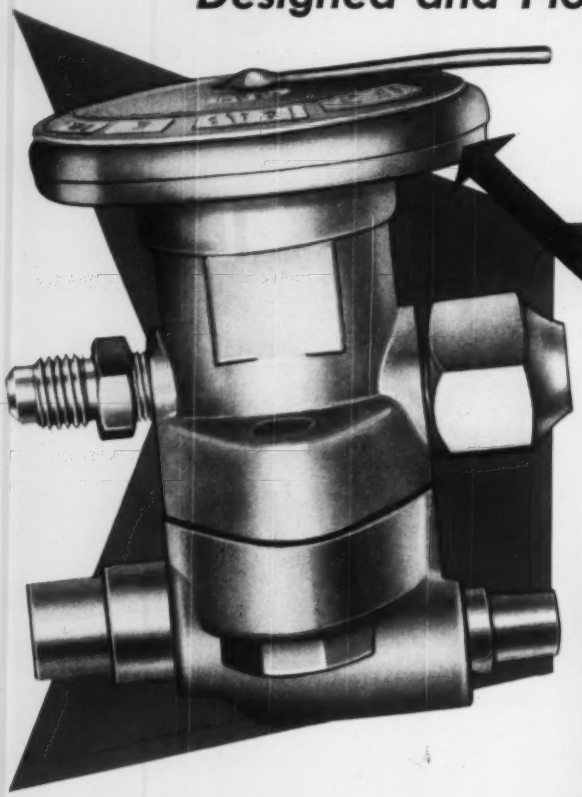
*City* _____ *Zone* _____ *State* _____

# 2 MORE IMPORTANT CONTRIBUTIONS TO THE REFRIGERATION INDUSTRY

## Designed and Pioneered by ALCO

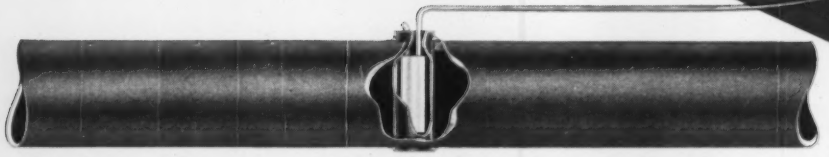


**1** ***The new Alco designed CONTOUR POWER ASSEMBLY***

Reduces extreme and unnecessary flexing of the diaphragm. Increases diaphragm life as much as 10 times over other designs. Standard construction on all ALCO "T" Series and "HTL" Valves.

**2** ***The new Alco designed RAPID RESPONSE REMOTE BULB & WELL***

- Reduces danger of floodback
- Extra-quick closing response
- Better control over wider range of operating conditions
- Economical to install in package units
- Available on all Alco Gas Charged Valves if specified.



***Look to Alco for advances in refrigerant controls.***

Call your Alco wholesaler.
Write for Bulletin No. 171-4.

ALCO

- *BUY SECURITY*
- *BUY QUALITY*
- *BUY ALCO*

**ALCO VALVE CO.**
861 KINGSLAND AVE. • ST. LOUIS 5, MO.

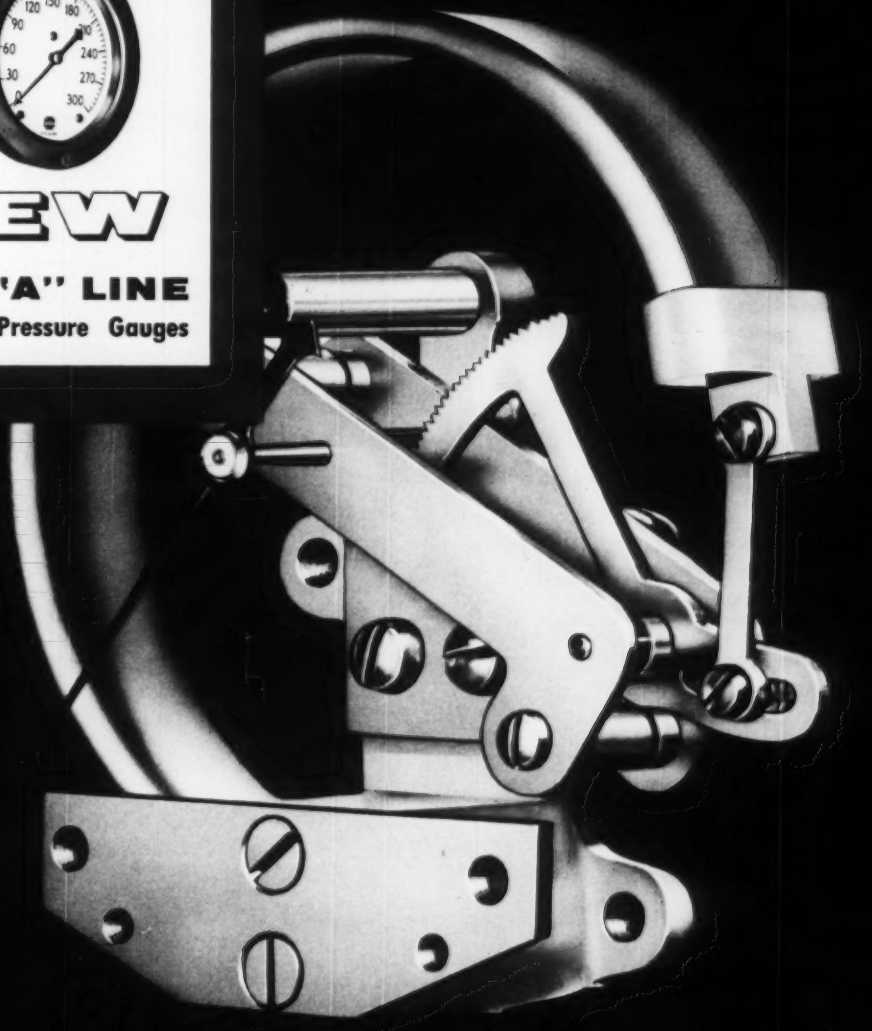
7890

**The one complete line of refrigerant controls: Thermostatic Expansion Valves • Refrigerant Distributors Solenoid Valves • Suction Line Regulators • Flooded Evaporator Controls and Reversing Valves**

# NEW

## USG "A" LINE

**Industrial Pressure Gauges**



# NEVER BEFORE A GAUGE VALUE LIKE THIS!

**MEETS A.S.A. GRADE A STANDARDS** . . . Guaranteed accurate within 1% of scale for the middle (working) half of scale, and 1½% for remainder.

**HAS PREMIUM GAUGE CONSTRUCTION** . . . Wide choice of options in cases, movements, tubes, sizes, and ranges—including many features of USG's premium line.

**PRICES ARE LOW!** You'll have to see the new USG "A" Line gauges to believe all they offer . . . at up to 40% below premium prices.

*(please turn page for more details)*

Call your USG Distributor for a personal demonstration of these features.

**UNITED STATES GAUGE**

DIVISION OF AMERICAN MACHINE AND METALS, INC., SELLERSVILLE, PA.

USG

*if you are looking for*

**ACCURACY**
**QUALITY FEATURES**
**LONG LIFE**
**EASY MAINTENANCE**
**LOW COST**
**GOOD DELIVERIES**

## HAVE YOU SEEN THE NEW USG "A" LINE YET?

**Call your USG Distributor for a personal demonstration of these features.**

**WHEN YOU SEE THESE GAUGES, YOU WON'T BELIEVE THE LOW PRICES!**

### FOR A HOST OF INDUSTRIAL APPLICATIONS

Be sure to check the new "A" Line models against your specifications for any of a broad range of industrial applications.

Save your costs of pressure measurements—principally where steam, water, and oil pressures must be indicated in:

**power and steam plant utilities • air conditioning and refrigeration systems • hydraulic presses • metalworking plants**

## CHOOSE FROM THESE STANDARD A-LINE COMBINATIONS

| | GAUGE APPLICATION | GENERAL UTILITY | | | | | | | | ALTITUDE | | | | | | | | REFRIGERATION (EXCEPT AMMONIA) | | | | | | | | AMMONIA | | | | | HYDRAULIC | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FIGURE NUMBER | 5001 | 5002 | 5003 | 5004 | 5005 | 5006 | 5007 | 5009 | 5021 | 5022 | 5023 | 5024 | 5025 | 5026 | 5027 | 5029 | 5041 | 5042 | 5043 | 5044 | 5045 | 5046 | 5047 | 5049 | 5061 | 5062 | 5063 | 5065 | 5067 | 5069 | 5091 | 5092 | 5093 | 5094 | 5095 | 5096 | 5097 | 5099 |
| AVAILABLE SIZES | 3½" | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 4½" | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 6" | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 8½" | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 12" | • | • | • | • | • | • | | | | | | | | | | | | | | | | | | | | | | | | | • | • | • | • | • | | | |
| CASE | Aluminum, Back Flange | • | • | | | | | | | • | • | | | | | | | • | • | | | | | | | • | • | | | | | • | • | | | | | | |
| | Aluminum, Front Flange | | | • | | | | | | | | • | | | | | | | | • | | | | | | | | • | | | | | | • | | | | | |
| | Brass, Back Flange | | | | • | | | | | | | | • | | | | | | | | • | | | | | | | | • | | | | | | • | | | | |
| | Cast Iron, Back Flange | | | | | • | • | | | | | | | • | • | | | | | | | • | • | | | | | | | • | • | | | | | • | • | | |
| | Cast Iron, Front Flange | | | | | | | • | | | | | | | | • | | | | | | | | • | | | | | | | • | | | | | | | • | |
| | Phenolic, Turret | | | | | | | | • | | | | | | | | • | | | | | | | | • | | | | | | • | | | | | | | | • |
| BOX | Steel Peaked, (Slip) | a | | | | • | | | | • | | | | • | | | | • | | | | • | | | | • | | | • | | | a | | | | • | | | |
| | Aluminum Peaked, (Threaded) | | • | | | | | | | | • | | | | | | | | • | | | | | | | | • | | | | | | • | | | | | |
| | Steel, (Hinged) | | | b | | | | • | | | | • | | | | • | | | | • | | | | • | | | | • | | | • | | | b | | | | • | |
| | Brass Peaked, (Threaded) | | | | • | | • | | | | | | • | | • | | | | | | • | | • | | | | | | | | | | | | • | | • | | |
| | Steel, (Snap) | | | | | | | | • | | | | | | | | • | | | | | | | | • | | | | | | • | | | | | | | | • |
| WINDOW AND RING | Brass | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | | | | | | | | | | | | | | |
| | *Stainless Steel and Nylon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | • | • | • | • | • | • | • | • |
| | **Stainless Steel | | | | | | | | | | | | | | | | | | | | | | | | | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| MOVEMENT AND TUBE | Phosphor Bronze | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | | | | | | | | | | | | | | |
| | Stainless Steel, 316 | | | | | | | | | | | | | | | | | | | | | | | | | • | • | • | • | • | • | | | | | | | | |
| | Stainless Steel, 403 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | • | • | • | • | • | • | • | • |
| SOCKET AND LINK | Brass | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | | | | | | | | | | | | | | |
| | Alloy Steel | | | | | | | | | | | | | | | | | | | | | | | | | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| CASE AND RING | Bottom | • | • | | • | • | • | | • | • | • | | • | • | • | | • | • | • | | • | • | • | | • | • | • | | • | | • | • | | • | • | | • | |
| | Low Back | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |

*Except 3½" size. **On 5090 series only, a stainless steel movement is used for 3½" size.

(a) Steel peaked slip ring, except for 12" where cast aluminum slip ring is furnished.
(b) Steel hinged ring, except for 12" where cast brass slip ring is furnished.

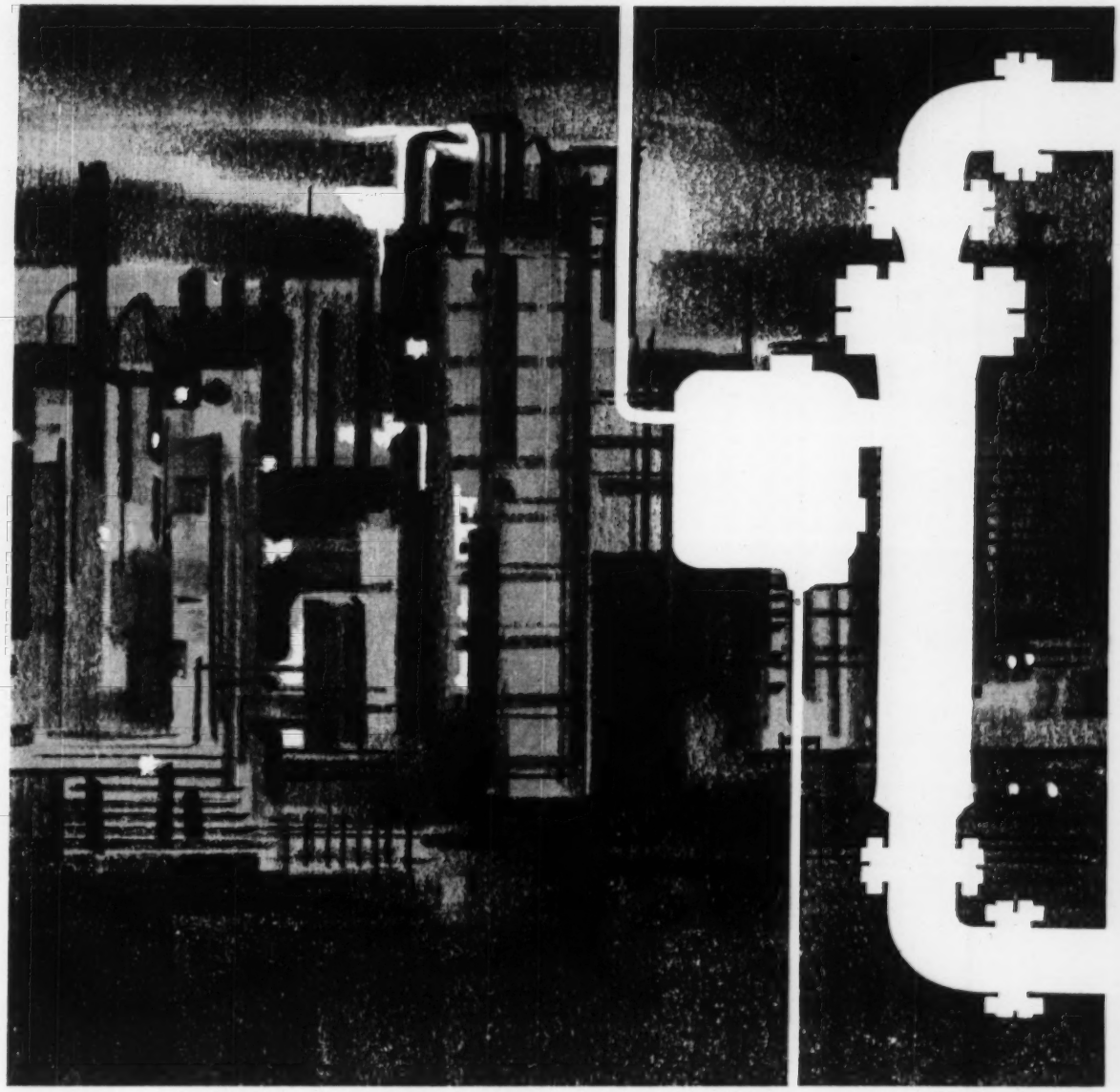
Find Your Nearest Distributor In The 'Yellow Pages'

For NEW CATALOG 305 "Pressure Gauges for General Industry", call your nearest USG Distributor . . . or write to us direct.

# UNITED STATES GAUGE

DIVISION OF AMERICAN MACHINE AND METALS, INC., SELLERSVILLE, PA.

USG



# Fisher Level-Trols—universally accepted in the power and process industries

High in sensitivity and accuracy! For full float range operation the Fisher Level-Trol is factory calibrated or zero adjusted to produce an accurate 3 to 15 psi or 6 to 30 psi signal output. Designed, engineered and universally accepted for most liquid level control, liquid level indication and interface control problems. Has simple liquid level adjustment indicating dial—combined pneumatic proportional band and specific gravity adjustment. Heavy-duty built—easy to operate—simple to service. Available with cage units for external mounting or internal top or side flange mounting with float sizes from 14" to 120".

**Write for Bulletin F4A for full details.**

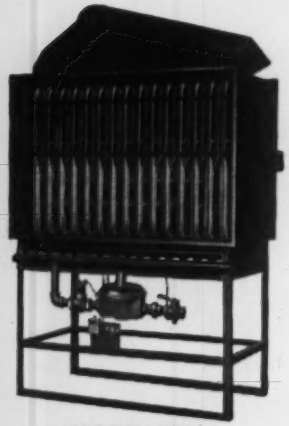
IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD...CHANCES ARE IT'S CONTROLLED BY...

**FISHER GOVERNOR COMPANY**

Marshalltown, Iowa / Woodstock, Ontario / London, England

**FISHER®** *Controls*

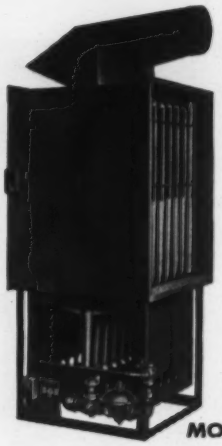
*SINCE 1880*



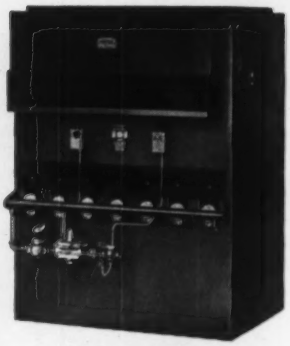
**MODEL SED-E**

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires. Either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.

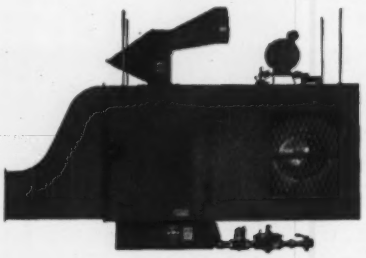


**MODEL SED-S**



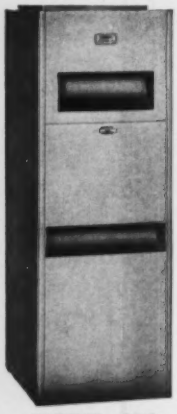
**MODEL SED-VF**

MODEL SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. Sizes from 70,000 to 280,000 Btu input.



**MODEL SEU**

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 480,000 Btu input.



**MODEL SEC**

MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower, glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input. For zero clearance.

HAYES

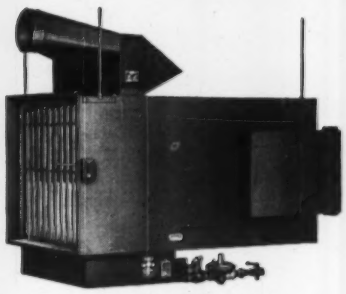
*FURNACES*

**outstanding for commercial, industrial, schools, churches, theaters, large residential**

**HAYES FURNACE MFG. & SUPPLY CO.**

3233 So. La Cienega Blvd., Los Angeles 16, California

Telephone TExas 0-3734



**MODEL SES**

MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

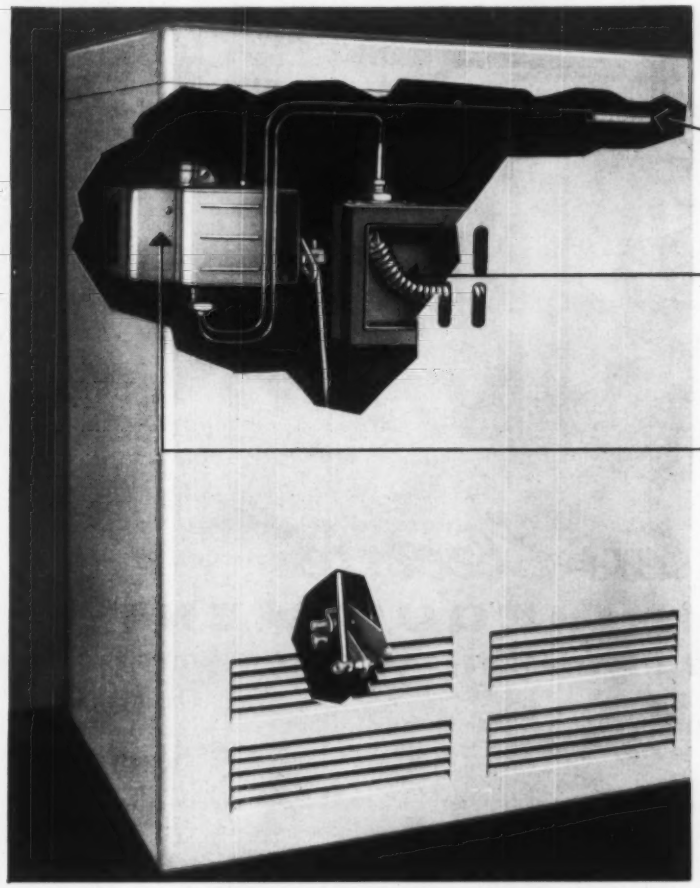
## REPRESENTATIVES

**M. Blazer & Son, Passaic, New Jersey.**
**Clark Equip. Co., Clearwater, Fla.**
**R. E. Holcombe, Atlanta, Georgia**
**Sinclair Heating Supplies, Ltd., Edmonton, Alberta, Canada.**
**Boyd Engineering Co., El Paso, Texas.**
**Reube O. Emery, Nashville, Tennessee.**
**F & D Distributors, Salt Lake City, Utah.**
**Leudecke Engineering Co., Austin, Texas.**
**McCombs Supply Co., Denver, Colorado.**
**O'Connor-Oklahoma Co., Oklahoma City, Tulsa, Oklahoma & Wichita, Kas.**
**Smith Steam Specialty Co., Kansas City, Mo.**
**Tay-Holbrook, Inc., San Francisco, California.**
**Dealers Supply Company, Atlanta, Georgia.**
**J. C. Lewis Company, Little Rock, Arkansas.**
**Nunn Electric Co., Lubbock, Texas.**
**Noland & Co., Newport News, Va.**
**Temperature Supply Co., Portland, Oregon**

THE MARK OF QUALITY

BARBER COLMAN

# New unit ventilator control provides greater accuracy, costs less to install!



Temperature sensing bulb in the discharge air stream.

Temperature sensing bulb in the room air sampling chamber.

(Aspirating principle insures exceptionally accurate and responsive control.)

Motor operator, controlled by the integral thermostat, is directly linked to the damper mechanism. This system provides automatically controlled heating and ventilating.

Positive spring return closes the outdoor damper in event of fan shutdown or power interruption.

**Dual Element Controller mounts directly on face and bypass units to control heating and ventilating**

This new all-electric Barber-Colman control combines the function of thermostat and controller in a single "package." It mounts directly on the unit ventilator, eliminating the need for a wall thermostat and substantially reducing control and installation costs. Factory installation is practical.

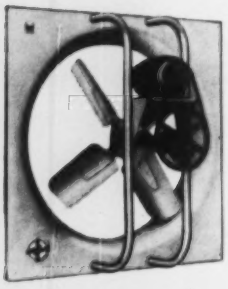
As illustrated, the control employs the sampling chamber system available on all face and bypass units. This is the proved aspirating principle used on the most difficult and exacting laboratory and industrial control jobs. As a result, control accuracy is superior to that of most wall thermostats (location of which is ordinarily a compromise).

For complete information on this outstanding cost-reducing improvement in unit ventilator control, ask for new Unit Ventilator Control Application file.

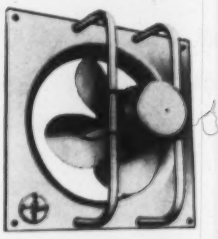
## BARBER-COLMAN COMPANY

Dept. G, 1301 Rock Street, Rockford, Illinois

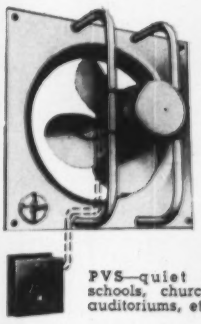
**One source . . . one responsibility for *both* air distribution and automatic controls**



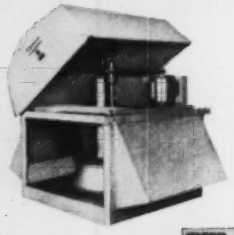
PVB—generally used in factories, warehouses and foundries.



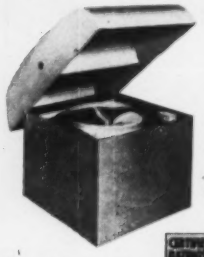
HS—for industrial use, farm buildings, laundries, etc.



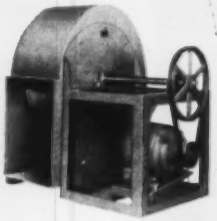
PVS—quiet for schools, churches, auditoriums, etc.



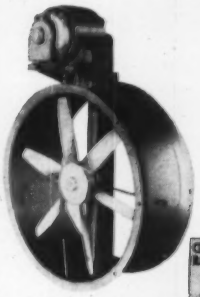
CENTRIFUGAL POWER ROOF VENTILATOR—for auditoriums, schools, churches, public buildings, plants.



PROPELLER-TYPE ROOF VENTILATOR—for apartments, plants, schools, etc.



BACKWARD CURVE BELT DRIVE UTILITY BLOWER—recommended for general ventilation.



DUCT or TUBAXIAL—for paint spray booths, etc. —explosion-proof.

# Peerless-Electric®

## AIR MOVING EQUIPMENT

***is designed for low initial cost and continuous, trouble-free performance.***

Peerless Electric air moving equipment offers the user low initial cost and trouble-free, continuous performance. Each unit is completely Peerless built. Motors are designed, engineered and manufactured in the Peerless Electric Motor Division. They are made to N. E. M. A. specifications and performance-matched to the fans or blowers they must power.

Each Peerless Electric unit indicated with the AMCA seal is rated by the new Air Moving and Conditioning Association. Installation data, performance tables, dimensions, ratings, general construction data, recommended specifications, and guarantee information are all available in the new Peerless Electric catalogs. Write for a complete set today.

**A COMPLETE LINE OF AIR MOVING EQUIPMENT**

Charter Member of the Air Moving and Conditioning Association, Inc. (AMCA)

Peerless-Electric

FAN AND BLOWER DIVISION

THE Peerless-Electric® COMPANY

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FANS • BLOWERS • ELECTRICAL MOTORS

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*Now*

**ANEMOSTAT®**

*presents*

**Standardized Constant Volume**

# TURBULATORS

The Anemostat Constant Volume Turbulator is a standardized high capacity dual duct unit handling from 800 to 7000 CFM. It provides an economical solution to many air distribution problems in which a large volume of air at controlled volume or pressure, and temperature, is involved.

With the Anemostat system, all thermal functions—heating—cooling—ventilating—are accomplished with air. Coils and resultant coil lag are eliminated together with required piping. Pressure losses are low and so are noise levels. Quality-built Anemostat Turbulators function automatically. They are easy to install, simple to maintain.

**Anemostat Constant Volume Turbulators provide zoning up to 7000 CFM with one set of controls—save money by replacing coil reheat zone-control with all-air system.**

New Bulletin gives important engineering data on Anemostat Constant Volume Turbulators. Write for your copy today.

**ANEMOSTAT®**

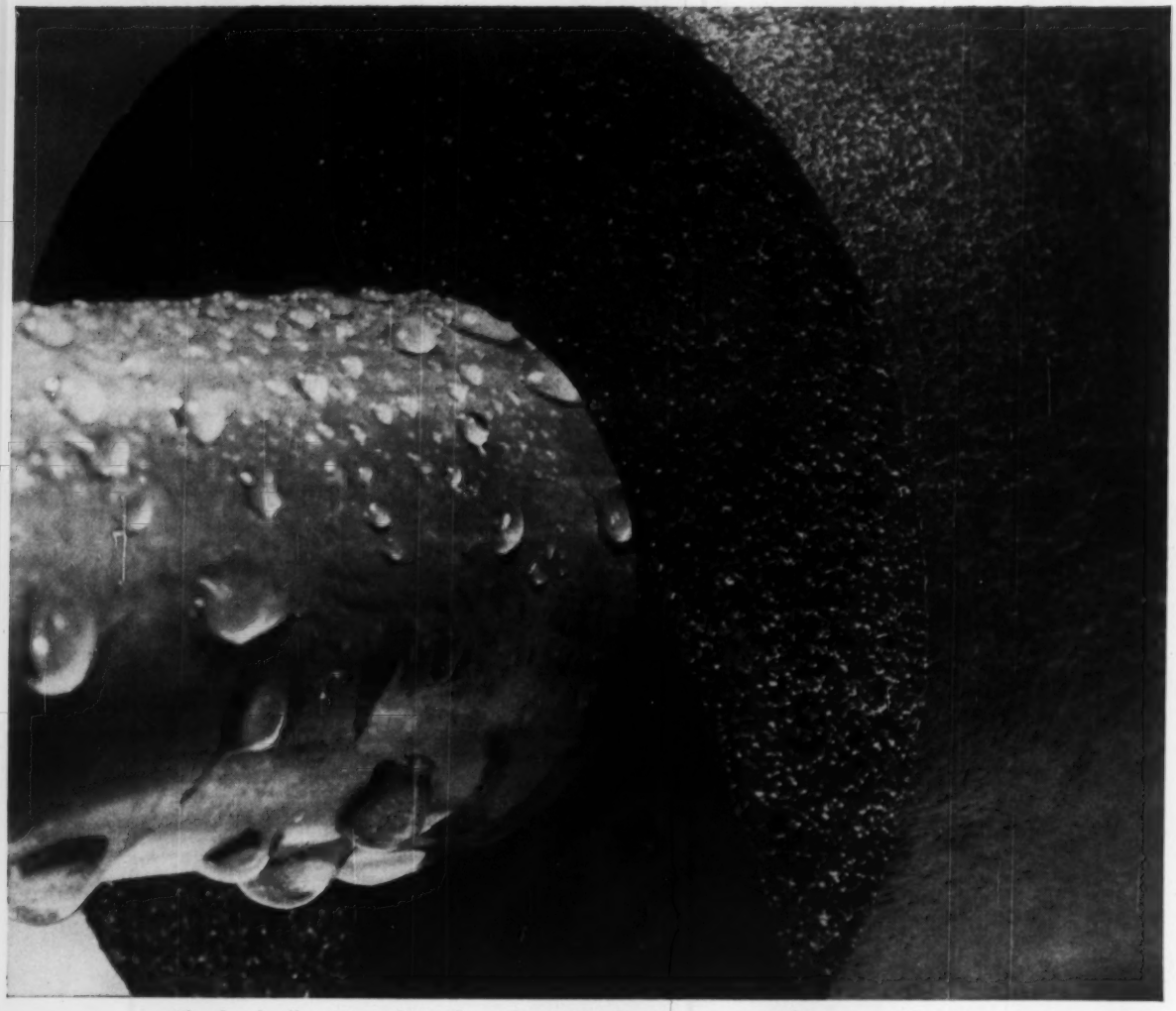
**DRAFTLESS *Aspirating* AIR DIFFUSERS**

**ANEMOSTAT CORPORATION OF AMERICA**

**10 EAST 39th STREET, NEW YORK 16, N. Y.**

**REPRESENTATIVES IN PRINCIPAL CITIES**

AC1363



The closed-cell structure of Armaflex seals out air and moisture, prevents dangerous condensation.

# Stop harmful condensation at temperatures down to 0° F. with Armstrong Armaflex

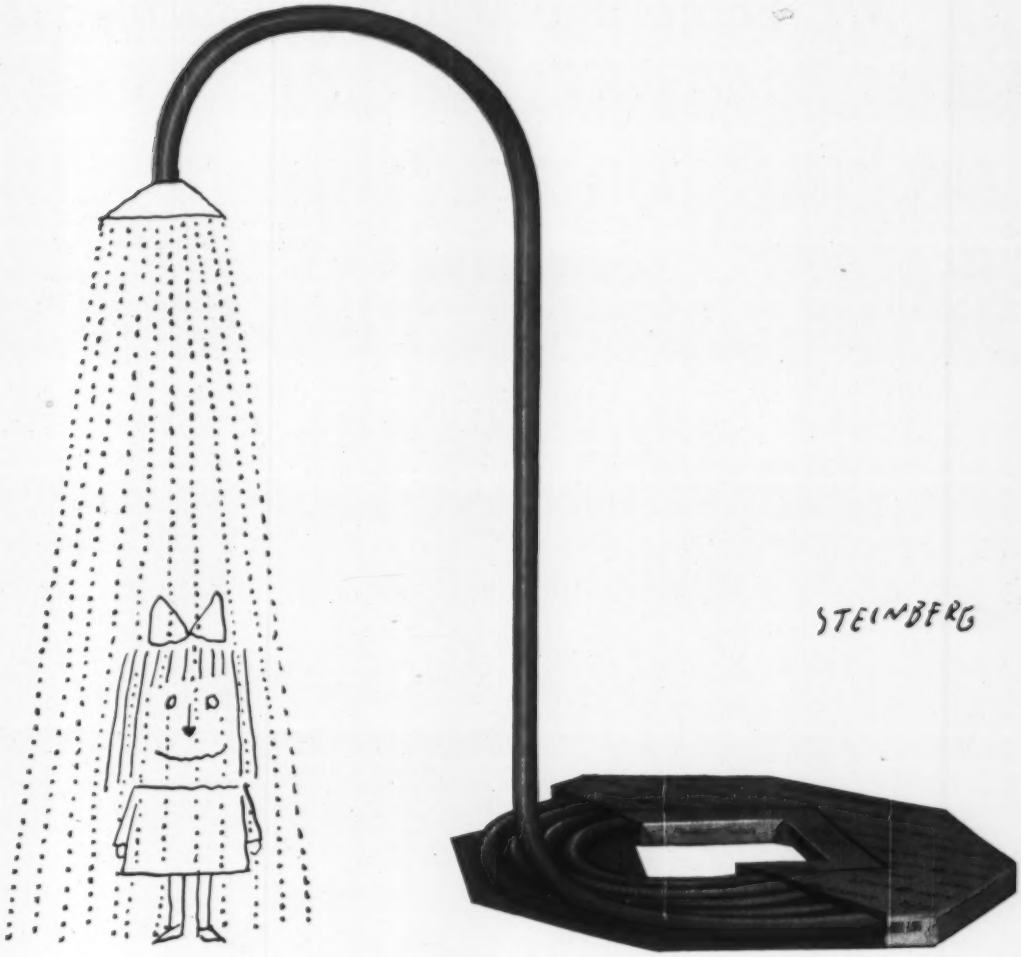
Self-extinguishing Armaflex is completely safe to install before sweat fittings are made. Armaflex is clamped back from fitting, then connection is made.

With the new ¾" thick Armstrong Armaflex Pipe Covering, condensation can be stopped on fluid lines operating as low as 0° F. Armaflex is a highly efficient, flexible insulation with a k-factor of 0.28 at 75° F. mean temperature. Its closed-cell composition needs no separate vapor barrier, effectively seals out air and moisture. At all temperatures from 0° to 200° F., you can specify the economical amount* of Armaflex because it comes in a complete range of nominal wall thicknesses—⅜", ½", and the new ¾".

Faster, more economical jobs result from use of Armaflex. This insulation can cut labor costs by as much as 50%, compared with application costs for conventional, old-fashioned pipe coverings. Armaflex can be slipped over piping before connections are made or slit and snapped on. Joints are sealed with Armstrong 520 Adhesive. Fittings are easily insulated with miter-cut pieces of Armaflex.

* **Recommended Armaflex thicknesses** for various service conditions are listed in a free, descriptive booklet. For your copy, write to Armstrong Cork Company, 2207 Sherman Street, Lancaster, Pennsylvania.

**Armstrong INSULATIONS**




# fastidious

*How to keep the Fountain of Youth from Aging...*

Lewin-Mathes Seamless Copper Tube and Pipe showers its benefits in a pure, steady stream on a little girl. And decades later, it will show equal regard for her grandchild.

Through the years, the Lewin-Mathes installation performs like new without maintenance because—as Copper Tube *Specialists*—we build Copper's resistance to everything except flow. Lewin-Mathes' fastidious-minded inspectors — at every operation throughout our *completely integrated plant*—demand shiny smooth surfaces *inside* as well as outside our products.

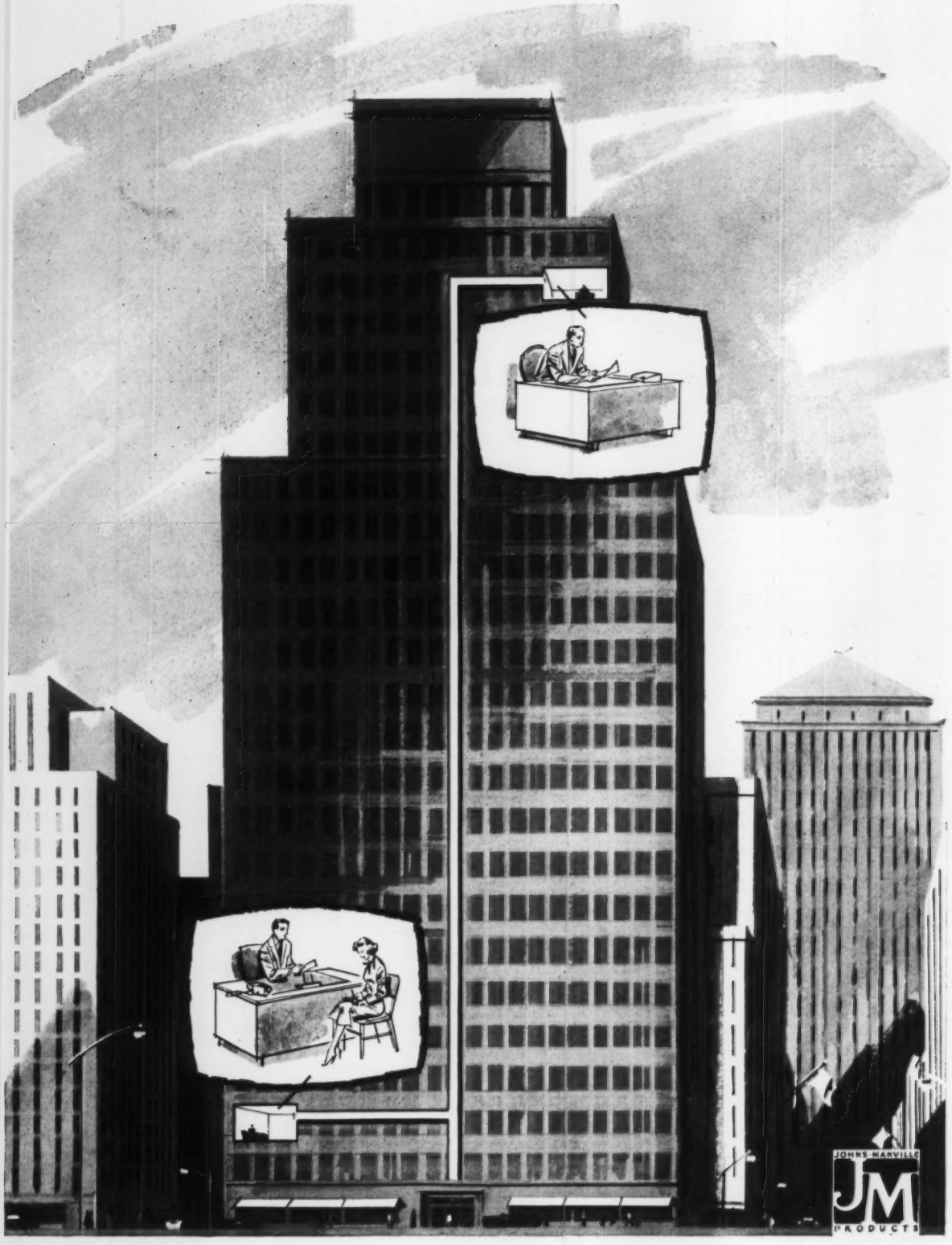
When installing piping materials, be sure that your *first* cost is your *last* cost. Ask your architect, designer or engineer to specify Lewin-Mathes.

**LEWIN MATHES**

SAINT LOUIS, MISSOURI

COPPER AND BRASS TUBE PIPE AND ROD
DIVISION OF CERRO DE PASCO CORP.

*Mr. Smith is 600 duct feet farther from*



*the fan room than Mr. Jones, yet . . .*

# both men work comfortably at the same temperature!

## when ducts are *fitted square and tight* with Johns-Manville semi-rigid Spintex Insulation

SEMI-RIGID SPINTEX® works two ways to lessen heat loss, stop condensation: first, with low conductivity . . . then, with its square, tight fit. The structural strength of this material, which is fastened snugly to duct surfaces with pins and clips, prevents "ballooning" due to duct leakage. And butted or mitred joints eliminate stretching and thinning of the insulation at corners. Instead, there's a full thickness of Spintex—with full protection against heat loss and condensation—over the *entire duct area.*

This two-way "edge" in insulating effectiveness is the big reason why leading engineers everywhere specify semi-rigid Spintex . . . for factories, institutions and office buildings of every description.

Produced by a new Johns-Manville spinning process, today's Spintex offers more insulating value than ever. Its mineral fibers are smaller in diameter, and substantially more uniform. This improved fibrous structure adds countless heat-blocking dead-air spaces per cubic inch to help keep working temperatures precisely the same throughout the structure . . . with minimum operating costs!

Your Johns-Manville sales representative will be pleased to send you information, along with samples of Spintex and J-M facing materials. Why not call him today. Or write Johns-Manville, Box 14, New York 16, N. Y. In Canada, 565 Lakeshore Road East, Port Credit, Ontario.

**LESS HEAT LOSS...NO CONDENSATION AT CORNERS!**
Semi-rigid (not flexible) Spintex fits squarely and tightly all duct surfaces. Stretching and thinning at corners, unavoidable with wrap-around insulations, are eliminated completely. Instead, Spintex retains full thickness everywhere to stop heat loss and condensation. Its structural strength prevents "ballooning."

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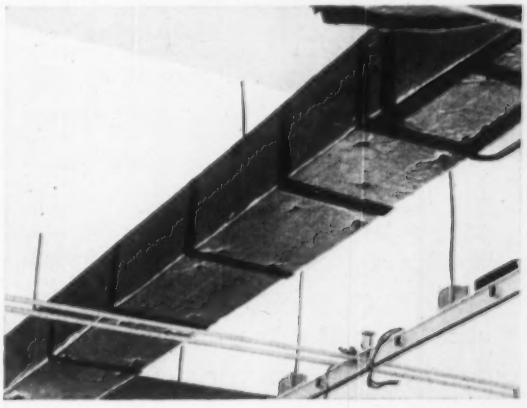
Spintex is clean, sanitary and "friendly" to handle. It cuts readily with an ordinary knife. Installs quickly, easily, even when ducts are curved or in difficult-to-reach areas.



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**JOHNS-MANVILLE**

The twin problems of high temperature and humidity, augmented by excessive heat from electronic equipment and klieg lights, are effectively overcome in the new WWL-TV building* in New Orleans by Thermal central plant type and multizone air conditioning units.

The entire conditioning system has been carefully designed to handle heavily loaded areas, such as studios and amplifier rooms, without overcooling other parts of the building. In summer, the typically muggy, sultry, New Orleans atmosphere is made mountain fresh, while in winter, the year around Thermal units warm the building just as effectively.

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*Architects: Diboll-Kessels & Associates
Consulting Engineers: Joseph E. Leininger & Associates
General Contractors: Perrilliot-Rickey Construction Company, Incorporated
Mechanical Contractors: Emile M. Babst Company

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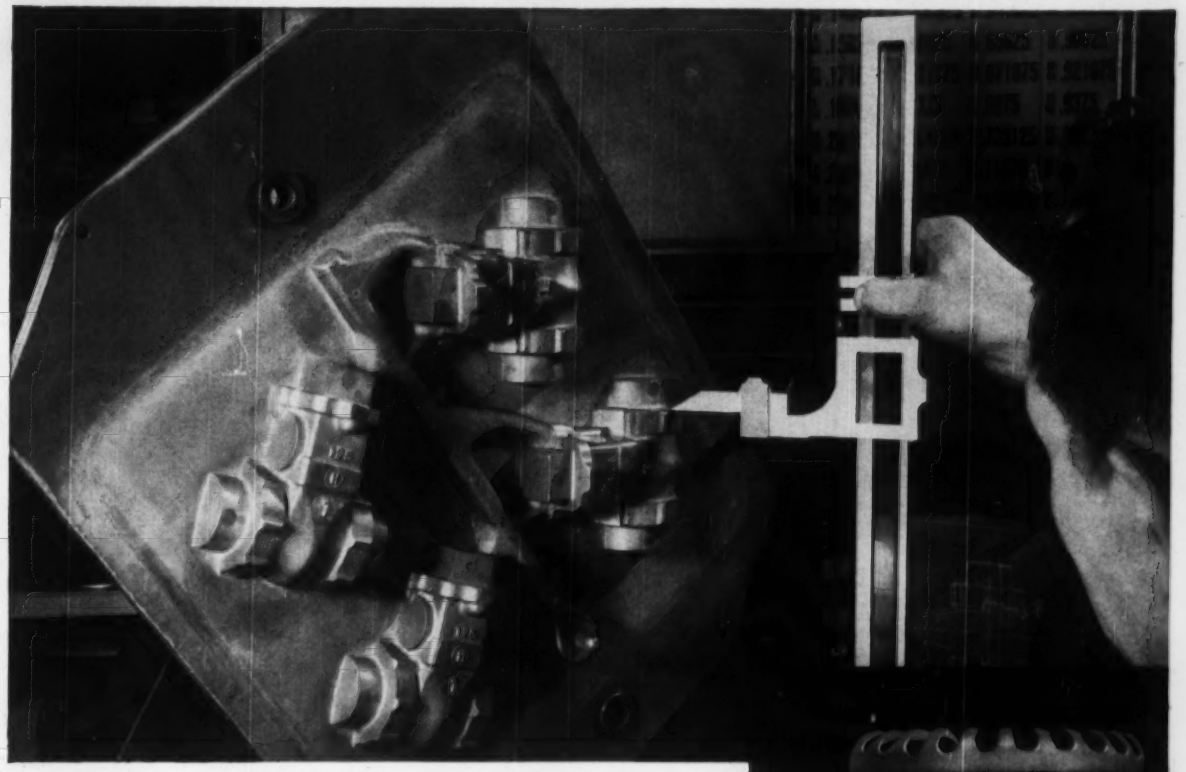


# *Engineered designs— over 550 of them*

The skilled pattern maker above is translating another carefully engineered design from Hammond's engineering department into a new bronze valve—specifically designed to most efficiently and economically perform a particular flow control function.

The new design will be added to the more than 550 types and styles of valves which Hammond now makes. For, at Hammond, where bronze valves are our only product, they receive the undivided attention of a first-rate engineering department—are not relegated to a secondary position. As a result Hammond offers a valve specifically adapted to your particular requirements.

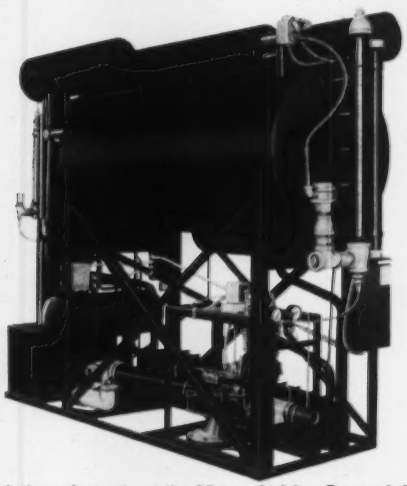
And the Hammond trademark on this valve is your assurance of quality second to none in the valve industry. For Hammond rigorously controls every manufacturing step from the melting of the virgin ingot to final individual testing. High volume production in a modern "automation" factory permits savings which are reflected in moderate prices for valves of outstanding quality.

A new catalog, No. 158, describes Hammond's complete bronze valve line. If you haven't already received your copy, write today to Hammond Brass Works, Hammond, Indiana.

*Hammond Number 435C plug-type globe valve with 500 Brinell stainless seat and disc. Rated for 300 lbs. steam, 600 lbs. w.o.g. Similar models available in 150 and 200 lb. classes.*

**HAMMOND *BRITE-KOTE*® BRONZE VALVES**

ARCHITECT: JOHN P. STANN; CONSULTING ENGINEER: J. B. WYBLE; BUILDER: SAM ZIG



Check these facts about the 25-ton **Arkla-Servel** Cooler

- A compact unit, easy to install and light enough for rooftop installation.
- Costs are low for installation, operation and maintenance. No specially trained operating or maintenance personnel are required.
- Can be installed singly or in banks to fit any size installation.

# "...now we're cooling with GAS!"

**Arkla-Servel** Gas Air Conditioning keeps customers cool and operating costs down at the Motel Washingtonian

"While we were planning the Motel Washingtonian, we made a complete study of all potential equipment," states Sam Eig, builder and corporation president of this modern motel near Washington, D.C. "We knew we wanted gas for cooking and heating, and after our investigation, we found gas best for *all* operations."

For air conditioning, the specifications called for Arkla-Servel gas absorptive coolers. "With our Arkla-Servel units, we have no maintenance problems," adds Mr. McKeever and Mr. Eig. "And we were able to tie them into our heating system without worrying about special housing, vibration, or noise. Our one central system cools in summer, heats in winter to provide us with a quiet, year-round economical operation."

With the new Arkla-Servel gas absorptive cooler, your clients get extra—even exclusive—advantages that only a gas cooling system gives.

- High efficiency at all times—even during the light loads.
- Constant temperature control.
- Instant automatic adjustment to match actual cooling requirements.
- Dependability of fuel service at all times.

Gas absorptive cooling can put your commercial and industrial clients' heating plant on a year-round paying basis, too. For specific information, take advantage of the consulting services provided by your gas company. They have trained specialists who have been working with architects and engineers for years. Check the facts about gas and you'll see—modern gas air conditioning out-performs all other fuels. *American Gas Association.*

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. . THROUGH CHEMISTRY

# The family has grown!

## ... in size ... in importance

The addition of a new and finer McDonnell 2-inch valve rounds out a line of safety relief valves for hot water space heating boilers that fulfills a vital need supremely well.

To know how true this is go back over the modern history of relief valves. With the rapid increase in closed systems, casualty companies, the National Board, and others concerned with boiler and heater safety went to work . . . and the net result was today's commendable A.S.M.E. Boiler Code calling for certified Btu-rated relief valves.

Closely following this work, McDonnell & Miller developed the first of all Btu-rated relief valves. They were not only first into the field; they are still first. They not only conform to the letter of the code; they go beyond this: *introduce new standards of their own.*

**For Hot Water Space Heating Boilers**

| McDonnell Valve No. | Boiler Size Btu./hr. | Opening Pressure | Inlet | Outlet |
|---|---|---|---|---|
| 230-¾ IN.-30 | 303,000 | 30 lbs. | ¾" | ¾" |
| 240-¾ IN.-30 | 513,000 | 30 lbs. | ¾" | 1" |
| 230-1 IN.-30 | 743,400 | 30 lbs. | 1" | 1" |
| 240-1 IN.-30 | 910,000 | 30 lbs. | 1" | 1¼" |
| 230-1½ IN.-30 | 1,025,100 | 30 lbs. | 1½" | 1½" |
| 240-1½ IN.-30 | 1,560,000 | 30 lbs. | 1½" | 2" |
| 240M-3 | 2,313,000 | 30 lbs.<br>36 lbs. | 2" | 1"<br>2" |
| 240M-4 | 2,710,000 | 30 lbs.<br>36 lbs. | 2" | 1¼"<br>2" |
| 240-2 IN.-30* | 3,130,000 | 30 lbs. | 2" | 2½" |
| 240-2 IN.-36* | 3,550,000 | 36 lbs. | 2" | 2½" |

*Recommended installation: 36 lb. opening valve, with smaller auxiliary valve set at 30 lbs. for thermal expansion.

## New Bulletin P-33 gives up-to-the-minute facts

- A new bulletin shows why and how the entire rated capacity of McDonnell Relief Valves is obtained without diaphragms or other auxiliary lifting devices.
- It shows how this operation—this operation so basic to safety—is ideally accomplished by using specially calibrated "low rate" springs, matched to disc area to give smooth precise lift and tight closure.
- It explains the widely adopted McDonnell principle of progressive settings that keeps discharge in step with function . . . small valve relieving normal expansion; large stand-by valve ready for the emergency.

These and many more significant facts are covered in the bulletin. Note the accompanying table listing a valve for practically every boiler—McDonnell quality straight across the board.

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*Safety Relief Valves*

Boiler Water Feeders • Low Water Fuel Cut-offs • Pump Controllers • Flow Switches • Related Liquid Level Controls for Tanks, Mills, Air Conditioning Systems

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# CHICAGO SUN-TIMES

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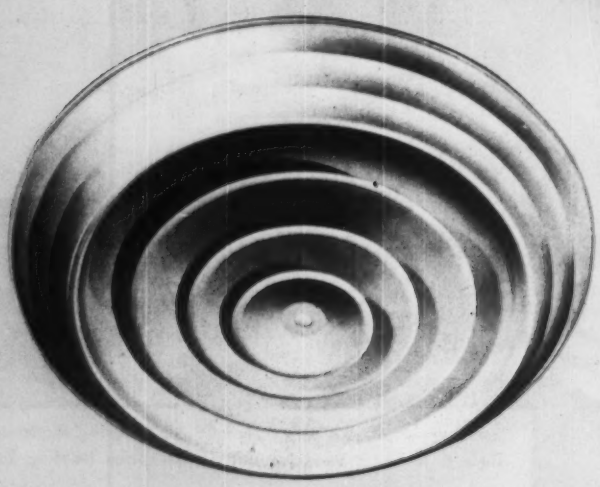

**CARNES DIFFUSER, FORM 2**

Look into today's new buildings—you'll see Carnes Air Diffusers—selected by owners, architects, engineers, and ventilating contractors for several important reasons.

First of all, these diffusers offer top performance, beauty of design, and air pattern adjustability. Form 2 is available in adjustable Model EJ, or in fixed cone Model E. Equipped with a radial damper, Form 2 Diffuser evenly distributes primary air in a truly radial pattern.

Another reason for the popularity of Carnes Diffuser, Form 2 is the fact that it is truly a *smudge-proof* diffuser; designed to the specific depth in each size to definitely eliminate ceiling smudging. This feature affords substantial savings in ceiling maintenance.

*Write for Carnes Catalog No. 56. Address the Carnes Corporation, Department AR, Verona, Wisconsin.*

CARNES

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# —the zinc stays on

**Pittsburgh Sheet Metal Duct Company** uses USS Galvanized Steel Sheets for their complete line of ductwork. That's because they want nothing but the best.

Pittsburgh Sheet Metal Duct Company buys USS Galvanized Steel Sheets in coils. Then they shear to length, bend, crimp and punch, roll, bead and lock-seam the galvanized steel. And no zinc flakes off the base metal.

**You can get** the same superior results in *your* ductwork when you use USS Galvanized Steel Sheets.

*USS is a registered trademark*

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**"B&W Welded Stainless Steel Tubing resists corrosion because it is fully annealed and precision made**

**As a design engineer working with heat exchanger and condenser applications, I know the importance of selecting tubing that's fully annealed. That's why I choose B&W Welded Stainless Steel Tubing. It gives me resistance to corrosion, ease of fabrication and close tolerances that I want."**

B&W's production practice of fully annealing all welded stainless steel heat exchanger and condenser tubing and performing a minimum amount of cold work after heat treatment achieves the ideal condition of maximum general corrosion resistance and close size tolerances. This provides ease of fabrication and threading of tubing through baffles and tube sheets and minimizes the possibility of failures in service due to combinations of stress and corrosion.

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TA-8007-PG-2

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## Building Picture Brightens; Contracts Up 4 Percent

*. . . over April last year*

CONSTRUCTION CONTRACTS in the U. S. showed a highly encouraging increase in April, according to figures released by F. W. Dodge Corp.

Dodge vice president and economist George Cline Smith noted that this marked the first break in a series of declines which began last November. Practically all categories showed improvement.

The April contract total was $2,881,011,000, an increase of 4 percent over April of last year. The first three months of 1958 had been down 11 percent below the same period of 1957.

The residential building category showed its first increase of the year. The dollar total of $1,240,217,000 amounted to a rise of 1 percent, and the number of dwelling units covered by the contracts was up 4 percent.

"The fact that units rose more than dollar volume in residential building," Dr. Smith explained, "was probably due to a sharp shift toward apartment buildings and two-family houses, which have relatively lower per-unit costs. The number of units in one-family houses in April was just about even with last year, but units in apartments were up 26 percent and two-family units were up 38 percent."

The figures indicated that April contracts for nonresidential building in April totaled $957,796,000, up 14 percent from the level a year ago. This was also the first percentage increase of the year in nonresidential building.

"The sharpest nonresidential increases," Dr. Smith said, "were in public buildings, up 83 percent, and in hospital buildings, up 53 percent. The bulk of the nonresidential increase, however, was accounted for by two larger categories: commercial buildings, up 19 percent, and schools, up 4 percent. Religious buildings also rose by 12 percent.

"While contracts for manufacturing buildings were down 16 percent in April, this is much smaller than the decline of 46 percent reported for the first quarter of 1958, so even this negative figure amounts to a substantial improvement."

Heavy engineering contracts, totaling $682,998,000, were down 3 percent below April of last year. In this group, public works contracts were up 22 percent, but public utilities were down 48 percent. Dr. Smith noted that the latter decline was largely accounted for by the fact that two extremely large electric utility contracts amounting to $109,000,000 brought the April total last year up to an unusually high level.

"These figures have highly encouraging implications for business in general, as well as for the construction industry," Dr. Smith said. "The contract figures tend to lead changes in business activity, and while one month doesn't make a trend, the April contracts give some grounds for a more optimistic view of the business outlook."

The cumulative total of contracts for the first four months of 1958 amounted to $9,594,356,000, down 7 percent from the like 1957 period. Cumulative totals in the major construction categories showed: nonresidential, at $3,418,863,000, down 7 percent; residential, at $3,806,279,000, down 6 percent; and heav engineering, at $2,369,214,000, down 10 percent. ≠

## Unseen Apparatus Marks Air Conditioning Trend

*. . . for new office buildings*

THE TREND toward unseen air conditioning apparatus of the future is illustrated by equipment currently being installed in the new headquarters of Guarantee Mutual Life and major addition to United Benefit of Omaha, according to Carrier Corp.

Conditioned air from units imbedded in the floor at the base of the glass siding in Guarantee's new home office creates an invisible wall to neutralize winter cold or summer heat. This is believed to be the first recessed installation of these units.

In winter when a portion of the structure may be in shade and another in direct rays of the sun, it is possible for one of the units to provide heating while an adjacent one is cooling. ≠

## Offers Tips on Reducing Cost of Air Conditioning

*. . . John Haines addresses BRI*

SOME SUGGESTIONS on how to reduce both initial cost and operating expense for year 'round air conditioning systems in commercial, public, and industrial buildings have been offered by John E. Haines, vice president, Minneapolis-Honeywell Regulator Co.

He told the seventh annual Building Research Institute in Washington recently that use of activated charcoal filters and a reduction in the amount of glass used in modern construction would mean substantial savings in air conditioning costs.

Mr. Haines said that use of activated charcoal filters may result in a 10 percent reduction in the amount

of outside air needed in an air conditioning system, with a comparable decrease in refrigeration capacity.

"It is, of course, expensive to heat outdoor air in winter and cool it in summer," he pointed out.

"In the Chicago area, for example, it costs an average of $50 a year to heat 1000 cfm of outdoor air and about $29 annually to cool the same amount. Therefore, if the minimum quantity of outdoor air can be reduced and still accomplish removal of odors and gases, a substantial saving will result in the first cost and operating expense of heating and cooling."

Mr. Haines said that if an air conditioning system in Chicago requires a total of 100,000 cfm and 20 percent minimum outdoor air, this quantity of 20,000 cu ft of outdoor air could be reduced to 10,000 provided activated charcoal filters were used.

This would make it possible to reduce the refrigeration in size proportionate with the reduction of 10,000 cfm of outdoor air, which — at 2.5 tons per 1000 cu ft — would amount to 25 tons, he added.

"Using an average first cost of $273 per ton, this would reduce the cost of the refrigeration system by $6825. If we deduct the cost of charcoal filters, the net savings in first cost would amount to $2495. Approximately $550 would be saved annually in operating costs."

There is also a possibility for additional economies in first costs of the source of heating if the installation is large, Mr. Haines revealed.

While emphasizing he is not opposed to the use of glass in construction, Mr. Haines said the fact must be faced that wide expanses of glass allow an excess of solar heat to enter the building, with resulting heavy demands on the system.

He pointed out that in a typical building 33 percent more cooling capacity is required to air condition an office with 74 percent of its wall space in glass than one of equal area having only 24.5 percent glass. Operating costs for the air conditioning also would be 26 percent higher. ≠

## 'Spot' Cooling Boosts Morale, Worker Output

*. . . in "hot" industries*

"SPOT" COOLING, tried at first as an experiment for industrial employee comfort, is reported paying substantial dividends in laundry, foundry, and other problem operations.

It is built around the concept of cooling people rather than space in establishments where air conditioning equipment for the entire plant costs more to buy, install, and operate than might be feasible or is otherwise impractical.

The report, made by the Utility Appliance Corp. cooling division, states that the use of spot cooling is growing in southern California, where application has been made by such firms as a laundry in the Lancaster desert area; the Pacific Telephone & Telegraph Co., which mounts units on poles to cool desert transformers and prolong their life, and an auto assembly plant, which uses evaporative coolers to cool cars that normally come out of baking ovens too red hot for workers to get at them and thus cause a production lag.

It continues that several laundry installations have improved employee morale, helped recruit and keep experienced workers, sharply cut absenteeism on hot days, and increased productivity by 20 or more percent.

A Detroit automotive wheel foundry's initial three units proved so successful that 19 more were added. From a health standpoint alone, introduction of spot cooling there cut a normal staff of three nurses who were always busy with heat prostration and other cases to a single nurse, according to the report.

In both laundry and foundry installations, the ductwork is placed overhead to avoid interference with job operations and movement of workers. The air is delivered to each worker through an individual adjustable register.

The cooling source is one or more evaporative coolers mounted in otherwise waste space on the plant roof. Each cooler supplies a continuous stream of cool, filtered air that helps keep down plant dust and dirt and, in turn, cuts down plant maintenance. One cooler may supply several registers.

The report says that the average operating cost of the cooling units is 1½ cents per hr and the amount of water used in cooling is negligible, since most of it is recirculated. ≠

## Industrial Gas Sales Decrease 4.6 Percent

*. . . under last March*

GAS UTILITY and pipeline industry sales during March amounted to 8346 million therms and represented a 9.9 percent increase over the same month a year ago, the American Gas Association reports.

However, industrial gas sales in March totaled 3144 million therms, a decrease of 4.6 percent from the 3294 million therms sold in March, 1957. Industrial production, as measured by the Federal Reserve Board index, was down 11.7 percent from the corresponding month last year. The index of industrial production (1947-1949 = 100) for March 1958 was 128, compared with 145 for the previous March. ≠

**"Quote"**

**"The technological strides that have been made are NOTHING compared to what you are going to see and do and become involved in within the near future. This may occur within a few years. Probably some of it will happen within a few months." — *B. F. Rose, Jr., manager, Architect-Engineer Div., Aerojet-General Corp., speaking at the 69th annual convention of the Mechanical Contractors Association of America at Los Angeles.***

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When you specify Custom Webster Walvector, you marry the heating system to the building design . . . blend them with each other for maximum comfort, beauty and economy. Never does Custom Walvector appear to be just "added" to a building. Instead, it becomes a part of the structure itself. And its wide variety of enclosure types meet every design need.

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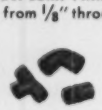

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These new cartons are being placed in the hands of Anaconda distributors as quickly as possible, but whether in the new package or not, Anaconda Fittings are the best you can buy. On your next copper job, use products that you can depend on—use Anaconda Copper Tubes and Anaconda Fittings.

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# "Open for Discussion"

*• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

## See Noise Level Prediction Method Correct, But Does It Simplify?

SEVERAL on the acoustics staff at Armour Research Foundation have read the article, *New Method Simplifies Predicting Noise Levels,* by R. A. Gerlitz, in the April and May issues, and feel that the information he presents is basically correct. It seems, however, that his approach to noise level prediction tends to make things a little more difficult to understand than before. But this is only our opinion and may not reflect the feelings of other readers.

There is one particular case where we feel that he could have improved his analysis. In one of his examples he uses a room 16 × 300 × 300 ft. This is not a typical room and its effect on noise produced by fans would probably be considerably different from that predicted by his equations. The equations are right for typical rooms. However, they generally do not apply to very low ceilinged, large spaces.

R. L. HULL
*Chief Engineer*
*DeBothezat Fans Div.*
*American Machine and Metals, Inc.*
*East Moline, Ill.*

THE AUTHOR'S REPLY — It is unfortunate that the illustration inadvertently covered a nontypical room with too low a ceiling. In such a room the noise level continues to fall with increasing distance from the noise source rather than remain constant. The rate of fall is, of course, far less rapid than it would be in open space. The assumption of a uniform reverberant noise field would give conservative results, fortunately.

As indicated in my article, all derivations given are mathematically rigorous. Therefore predictions will have the same degree of precision as with the conventional decibel approach, if the same precautions are observed with respect to the limitations.

R. A. GERLITZ
*Chief Engineer*
*Propellair Div.*
*Robbins & Myers, Inc.*
*Springfield, Ohio*

## Think HTHW, HTW Both Bad Terms; Suggest "High Pressure Hot Water"

IN THE "Open for Discussion" pages in the April issue, Erik B. J. Roos suggested that the term *high temperature hot water* for water at 380 F be replaced by *high temperature water.*

While agreeing to the "hot" being redundant to the above expression, I think nevertheless that both terms are bad, since neither states the essential quality of the heating medium without which the high temperature could not exist, and that is the pressure.

To be successful, terminology should not be made for the fellow engineer who knows, but for the other who does not. In other words, the term should be understood by all. It has been my experience that when you talk about hot water heating, you are often required to explain how you can maintain the water at such elevated temperatures.

I suggest therefore that the term *high pressure hot water* be employed. We at J. O. Ross Engineering have been using this term successfully since 1936 when we made the first such installation in this country.

Furthermore, there are several distinct pressure ranges in hot water heating: a low pressure range with supply temperatures of 180 to 220 F, a medium range of about 250 to 280 F, and a high range with temperatures in excess of 300 F.

All these require a basically different approach. How then should we distinguish them in the proposed terminology? *High pressure hot water, medium pressure hot water,* and *low pressure hot water* — or in their abbreviations, *HPHW, MPHW,* and *LPHW* — are good terms which surely cannot be replaced by *high temperature water, medium temperature water,* and *low temperature water. Low temperature water* surely would scarcely suggest a heating medium, whereas 200 F is a very high temperature to most people.

Mr. Roos further suggested that the equipment nomenclature *hot water generator* be substituted for the *boiler* in hot water heating systems in which no steam is generated. Although this objection is basically justified, I disagree simply because of lack of a better word. There are many different types of high pressure hot water systems. Each has a hot water generator, but they are not all direct fired. The term *boiler* is commonly understood to denote just such a direct fired heat exchanger and needs no further explanation.

E. G. HANSEN
*J. O. Ross Engineering Div.*
*Midland-Ross Corp.*
*New York, N. Y.*

*(Continued on page 62)*

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(Continued from page 59)

## Query Authors of Heat Pump Article On How Heat Loss Was Calculated

I HAVE READ with considerable interest the article, *Maintenance, First Cost Analyses Favor Heat Pump Installation*, by John M. Kearney and Herbert Peters, in the March issue. I would like to make one or two comments.

The article states that the first and second floors are 16 ft floor to floor and the basement is 12 ft floor to floor. From this, I would assume the building has two floors and basement.

I am sure that the authors realize that, in the design of a heat pump system for a building of this type, it is essential to take all possible steps to minimize heat losses, whether they be transmission losses or associated with the ventilation air. Also, it is important to make the most accurate estimate possible of the true heating requirements of the structure.

I think that other readers would be interested in the steps taken by the designers of this system to minimize heat losses and, more important, it would be helpful if the authors had developed in more detail the heat loss which is given as 596,000 Btu per hr. The specific questions in my own mind with respect to the latter point are:

1) How much of the heating estimate is attributable to the ventilation air?

2) Was the design ambient temperature modified in any way to account for a normal daily range? In other words, was any recognition taken of the storage capacity of the structure?

3) Was any credit taken for internal heat gains in making the heating estimate? These heat gains would, of course, include such items as lighting, people, miscellaneous electrical power input, etc.

One of the most important aspects of such a job is the solution of certain problems relating to the changeover of the refrigeration system from the heating to cooling regime, or vice versa. Some discussion of the refrigeration system itself on how these problems were handled in this particular instance would be very informative.

EVERETT P. PALMATIER
*Manager*
*Transportation Equipment Dept.*
*Carrier Corp.*
*Syracuse, N. Y.*

THE AUTHORS' REPLY — The assumption that the building has two floors and a basement is correct.

It was, of course, necessary to absolutely minimize all heat losses. Further, it became apparent that the building could be "tailored" to using a refrigerant compressor for heating, initially, by minimizing the winter transmission load. To accomplish this, the cooperation of the architects was secured in matters regarding use of materials for building construction.

The roof insulation was increased from 1½ in. to 4 in. thick, reducing the winter load by 54,500 Btu per hr. Window panes of two layers of glass separated by a hermetically sealed vacuum were used throughout in lieu of single glass, and only a minimum number of operable sash were installed. This reduced the load by 167,000 Btu per hr. Additionally, the cavity wall construction included 1½ in. insulation.

In order to reduce the ventilation air load to a minimum (242,000 Btu per hr), only sufficient outdoor air (3200 cfm) was introduced to make up toilet exhaust and to moderately pressurize the building. This quantity, which amounted to 12½ percent of the total air supplied, was well within recommended design criteria. To assure a positive sense of "freshness," full supply capacity activated carbon air purification cells were installed.

Since the building is occupied 24 hr a day, seven days a week the design ambient temperature was not modified. All spaces are maintained at a specific dry bulb temperature at all times, 365 days a year.

Credit was taken in calculating the winter load for all electrical items producing heat and for heat from occupancy. This quantity (approximately 100,000 Btu per hr) reflected the least favorable indoor condition during the night function of the building.

The refrigeration seasonal changeover is actuated initially (except on the defrost cycle) by a manually operated summer-winter switch. A 3 min time delay takes place whenever this switch is removed from one position to another. At the termination of the 3 min period, which allows time for liquid refrigerant gravity drainage to receivers, the appropriate liquid line solenoid valves are energized and/or de-energized and the compressors are started. The pilot valves for the refrigerant four-way changeover valves, energized in accordance with the summer-winter switch setting, then allow for refrigerant gas pressure to position the four-way valves for correct seasonal operation. On the defrost cycle, static pressure sensing controls on the winter heat source coils override the summer-winter switch and actuate the switchover to summer cycle. When the condensing pressure in the source coils increases to the pressure controller set point, the system is returned to normal operation automatically.

JOHN M. KEARNEY
*Mechanical Engineer*
*and*
HERBERT PETERS
*Electrical Engineer*
*PACE Associates, Architects and Engineers*
*Chicago, Ill.*

## Acknowledge Source of Illustrations Used in Hot Water Heating Article

IN THE ARTICLE, *How to Prevent Unbalance in Hot Water Heating Systems*, by T. Robert Stevens, in the April, May, and June issues, Figs. 17 and 18 were reproduced through the courtesy of Bell & Gossett Co.—Ed.

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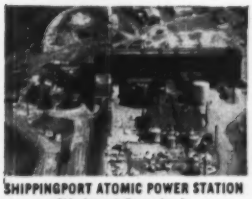

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Question of the Month

# What Causes Oily Soot Problem In High Velocity Air Conditioning?

***This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. Earlier answers appeared in the September 1957 and April 1958 issues. Other comments for publication are invited.***

*"We have encountered an oily soot problem in our office building air conditioning system. The building consists of seven floors above a garage at grade level and below.*

*"The air conditioning system consists of a perimeter system for zone control, and a hot and cold deck interior system. Both systems are equipped with automatic oil type filters as well as electric precipitator type filters in series. The perimeter system air intake is at the first floor level approximately 20 ft above grade; the interior system air intake is in the penthouse on the roof.*

*"Oily soot of 1/16 in. diam and smaller fluffy spherical particles is discharged from the high pressure primary air ducts of the perimeter system, and from the ceiling supply units. Dust checks on the precipitators and on the cooling and heating coils fail to show any signs of the soot; target plates coated with petroleum jelly installed inside the coil and filter plenum also fail to show evidence of soot.*

*"Could micron size particles of soot be agglomerated into larger particles downstream of the supply fans? I would like to know what is causing this problem and how we can correct it." — W.G.M.*

## Use Dry Type Prefilter Arrangement So Soot Stays Dry, Doesn't Stick

I HAVE READ with interest the various comments on the oily soot problem in the high velocity air conditioning system of a seven-story office building.

One reader suggests that outside air containing sooty particles might have been introduced into the ducts through small holes or perforations in the duct walls.

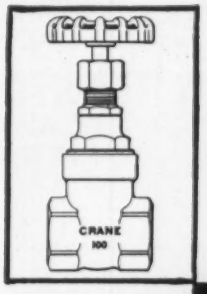
In order to function properly, a high velocity duct system must be completely airtight. Therefore the presence of small holes in the duct walls seems highly improbable. Also, even if there is some leakage there will be no inductive effect due to the high static pressure of the system.

Another reader proposes that the soot originates in one or both of the following sources: (1) the primary air stream carrying dirt through the ducts and supply outlets into the area, or (2) a secondary or induced air stream caused by the high velocity air at the diffuser.

It is generally acknowledged that smudging may be due to dirt carried in either the primary or secondary air stream, and that the source of smudging can be easily traced by checking the inside of the ductwork, especially near the diffuser openings. Only if the duct walls are found to be clean will discoloration of the ceiling be the result of dirt carried by the induced air stream.

However, a secondary air stream deposits *dry*, not *moist*, particles at the ceiling near the outer edge of the diffuser. The presence of oily deposits therefore suggests that the supply air itself is in an oily condition when flowing through the system. And this condition obviously will result in an oily film to be deposited in the conditioned area on furniture, curtains, and other objects.

In my opinion, the oily deposit must therefore be traced back to the oil filters. Dry soot particles passing across the oil filter bank will become moist and will travel in this state through the electrostatic filters into the duct system. The high velocity air stream will carry them even to the last branch and outlet of the system. When these moist particles are discharged

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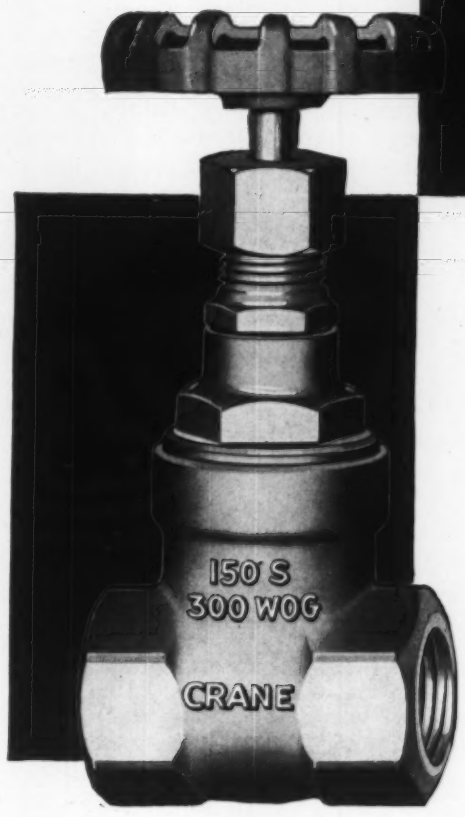


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through the outlet, they will — due to their oily adhesive state — cling to the ceiling and in time will cause strong discoloration.

I gather from the information supplied that the building is located in an area where gas fumes or other dirt agglomerations are heavily concentrated. I assume that dirt particles enter through the air intakes. To remedy the situation, it is, in my opinion, best to use a dry type of prefilter arrangement instead of the oil filter bank presently installed. Any small soot particles passing both the dry and electrostatic filter banks will then remain dry, will not have the adhesive characteristics of moist, oily particles, and will certainly cause much less smudging than is caused at present.

This suggestion is based upon practical experience. I have worked on a few installations where oily soot problems existed and where the steps proposed in the foregoing paragraph were taken with good results. If the filters are replaced, the duct system should be vacuum cleaned at the same time.

E. C. GRANT
*E. C. Grant Airconditioning Engineering Co.*
*Jackson Heights, N. Y.*

## How One Company Found Solution To Its Soot Accumulation Problem

THE Republic Publishing Co., Yakima, Wash., moved into new premises some five years ago with an air conditioning system designed specifically to their needs, with an oil bath rotary filter on the outside air intake, and a wash water bath or spray filter on the combined outdoor air and recirculated air duct. Humidity control is, of course, necessary in the printing industry due to the effect moisture has on paper. The water spray filter gave a certain amount of air conditioning control by evaporative cooling during the hot summer season.

It was not long after this system was put into operation that soot deposits were appearing throughout the plant, the carbon being carried over from the printing rooms. A serious fire hazard resulted from the accumulated soot in the duct system, not to mention the disagreeable conditions in the offices and plant itself, and undesirable contamination of printing work.

The Cameron-Yakima engineering firm was called in to remedy this situation and provided a filtering unit on the return air plenum composed of dust collecting filter banks followed by activated carbon filter banks. The filters are of the washable plastic permanent type, and are designed to capture the gross pollution — dust, lint, carbon, etc. — down to submicron sizes. This permitted the activated carbon filters to utilize a greater capacity to accumulate submicron particles, gaseous and solvent pollutions, etc., so that carbon filters needed to be reactivated or replaced about every two years, and the filters cleaned about every 8 to 10 weeks.

A report from the publishing firm stated that, in a year's operation with the new filtering and activated carbon system, the soot problem had been eliminated from the offices and plant, and that the ducts are being gradually cleansed of the five year accumulation of dirt and soot.

The company further stated that it believed that oil consumption for heating had been reduced since it was able to recirculate a higher proportion of the heated air in the building.

One independent testing laboratory reported that the filters had a reducing effect on both bacteria and mold counts when properly maintained, and, for the combined system, a reduction of 77 percent in the bacteria counts, and 85 percent in the mold counts, as compared with the outside air.

GEORGE H. CANTRELL
*Sales Manager*
*Stoddard Industries, Inc.*
*Chicago, Ill.*

**READER ASKS—**

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"There are no electrical contacts with the piping which could cause the electrolytic action that has been blamed by some.

"I have had no trouble in condensate lines.

"Any information from others on how they have coped with a situation like this will be greatly appreciated."—J.B.S.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

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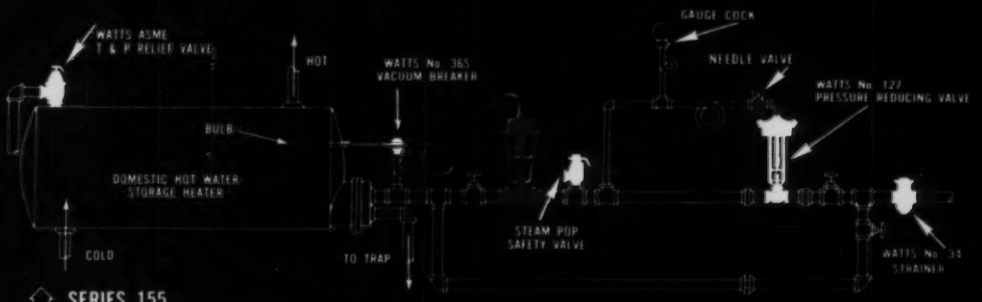


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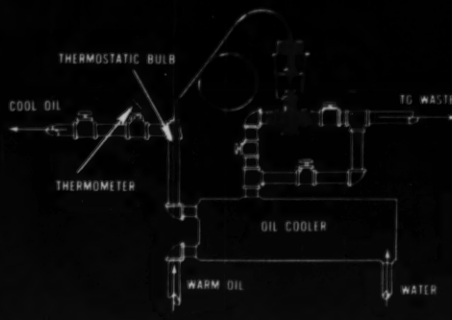


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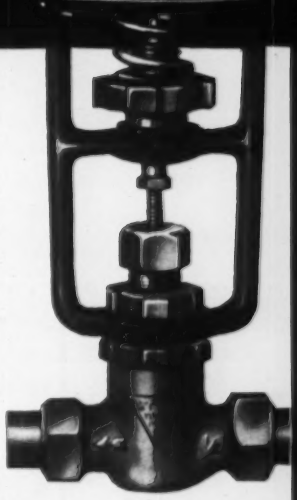

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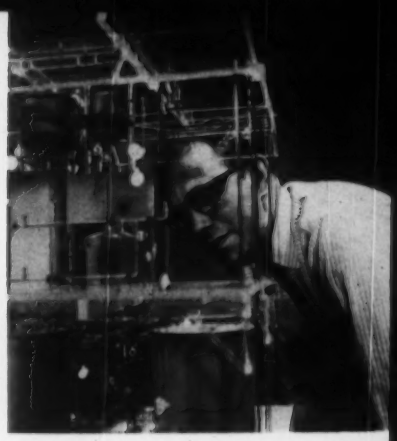
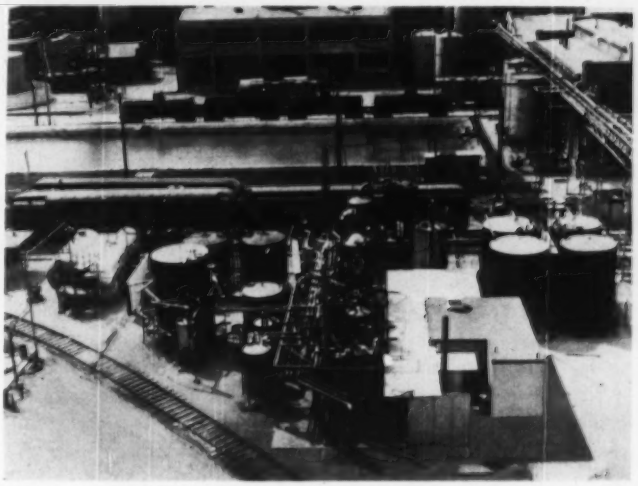


# Piping System Models Aid Design Communication

***. . . answer demands made by trend toward huge, complex industrial processing plants***

BY G. P. HAMMOND
Mechanical Engineer
Procter & Gamble Co.



THE technological advances of recent years have brought more and more giant process activities into industry. These require vastly more complex installations to be designed and constructed. With these advances has come a snowballing need for better, simpler means of communicating ideas and necessary information — all the way from design to the finished project.

Modeling has proved to be one effective answer in simplifying design communication. It has found increasing use for two main reasons:

- Models enable engineers and designers on a project to develop better design through better visualization.
- Models encourage management and research, development, and operating personnel — those who do not have time nor need to understand complicated engineering drawings — to contribute to the design.

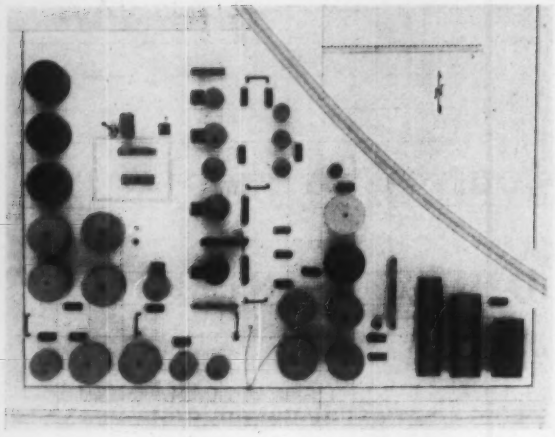
Procter & Gamble has used models increasingly for these reasons over the past 12 years. More recently the company has extended its use of engineering models. A new approach has been developed to take further advantage of a model by using it to communicate the design intent on piping, conduit, and ducts to construction personnel without the preparation of conventional drawings. This approach adds two more reasons —and two additional justifications through cost savings—for modeling:

- Engineering costs are reduced through elimination of many of the conventional drawings.
- Field construction cost is reduced through a clearer presentation of design intent.

More than 10 new process facilities have been completed at the company in the last year utilizing this technique.

Normally, two models are made on a project. In the early stages a preliminary equipment arrangement model is built, and, later on, a production engineering model. The preliminary model is used to study alternative layouts without making the large number of drawing studies normally required. The model base and pieces are supplied to the engineer responsible for the project. Shapes are simple and easily constructed, but they are three-dimensional and functional. The engineer shuffles them as he studies, rather than trying to reflect his thinking through a draftsman or a designer.

If the engineer wants a record of



PRELIMINARY EQUIPMENT arrangement model is used for layout study. Since this was process mat type of job, as contrasted to building with bays, grid sheet was used as base to help obtain proper relationships between equipment

the various alternatives, photographs are taken. Using photography he can study 20 to 30 plans quickly and economically. If necessary he can present alternative plans in photographic form for management approval. The main advantage of this technique is an improved and lower cost plan because of the better visualization attained and the wide degree of participation. In addition, the cost and time of study work are reduced.

Usually before the preliminary model has been started, a preliminary flow sheet has been prepared to establish equipment requirements and process flow. Also, as much equipment as practicable has been designed or selected, and the probable site or sites for the facility have been chosen. All of the design work on paper is kept as simple as possible.

Flow diagrams are drawn freehand, and the tank and pressure vessel designs are roughly sketched on a standardized sketch form. As much detail as can be is covered either by standard drawings or left up to the vendor to allow him to use his standard shop practices wherever it is not critical and will lower costs.

## Build Basic Engineering Model

Once approval of the preliminary arrangement model is obtained, it is necessary to do some architectural-structural design before starting the production engineering model. Although P & G has been successful in reducing or eliminating most of the conventional piping, duct, and conduit arrangement drawings, conventional structural drawings have not been eliminated. These drawings are necessary to build a basic production engineering model.

As the name implies, this model is a base on which to do further work. The basic model is constructed from equipment drawings and structural drawings using the approved preliminary equipment arrangement model to set the layout. No conventional equipment layouts are made at this point—they would have to be revised constantly.

Since the preliminary equipment arrangement model is somewhat inaccurate and the equipment models are built from rough information, the basic production engineering model is reviewed before piping design gets underway. This review is important; it gives operating, management, engineering, and research and development personnel a last crack at the layout before a lot of modeling design work has been done. By studying the basic model for a short time all of the reviewers are more inclined to make major contributions than they would be if they had to pore over drawings.

## Piping Presented Two Ways

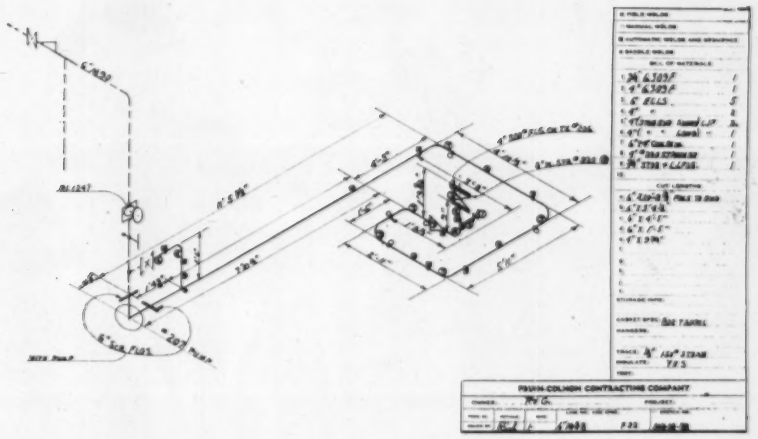
Piping on a model is represented in two general ways. One way—the fine wire technique—utilizes 1/16 in. diam brass wire for each pipe line, with various diameter rubber sleeves attached to the wire to represent the outer diameter of the pipe and insulation. The other way—the true scale technique—uses plastic tubes or rods whose OD represents the OD of the pipe to scale. Most P & G models have been built with the fine wire technique, but a true scale technique is being perfected to produce a model at comparable cost and give the advantage of increased visualization.

No matter which technique is used, piping is installed on the model directly from the flow diagram—few if any studies being made on paper. Sometimes it is necessary to check the feasibility of an installation when dimensions from fitting to fitting are involved. But these paper studies are kept to a minimum and the model is utilized as the study tool.

## All Piping Shown, Identified

Since it is the only means of communicating the design intent of the piping arrangement from the engineering office to the field construction forces, piping on the model is complete. Every pipe line, regardless of size, and every piping accessory are shown and identified.

Experience in model projects indicates that each pipe line is installed on a model an average of two times. Some pipe lines, naturally, will remain the way they are first installed. Others may be changed two or three times. In general, these revisions indicate that individuals have visualized the installation fully and ac-



FIELD SKETCHES for fabrication, erection are made on job by contractor from finished model located as close to construction site as possible. Model affords flexibility, permits coordination of various construction activities

curately and have seen a better way to do the job—probably at a lower cost. There is a saving in engineering cost, and usually even greater savings come from a better job and lower construction cost.

Frequent reviews are held to be sure the model represents the thinking and experience of the company's best qualified engineers. While it might be difficult for engineers to follow day-to-day progress of conventional piping drawings, they can do this very easily with a model. Too, this day-to-day contact produces a "team spirit" between designer and engineer.

### Review Fosters Suggestions

When the model is 90 to 95 percent complete, a final model review is held. Manufacturing department representatives and the design team go over the model with a fine tooth comb to make sure the facility will be constructed at minimum cost and will produce effectively with low maintenance cost. Suggestions from this review are incorporated in the model. It is obviously much easier to work them out on the model than in the field.

The final phase is to color code and tag the model for use in the field. This color coding and tagging is extremely important when conventional drawings on piping, conduit, and ducts are not being made. Each pipe line is painted with a color which identifies the construction specification. For instance, all conduits are painted green, all instrument lines are orange, and all safety items red.

When the model arrives in the field, it is placed as close to the actual construction site as possible. It is an excellent tool in the early stages of construction for planning the sequence of operations since all phases are combined in one three-dimensional picture. It helps settle any jurisdictional disputes, and it offers a quick way of orienting new personnel as they come on the job.

How the model is used specifically to build the facility depends somewhat on how the construction contract is being handled. Subcontractors often prepare their bids by making take-offs directly from the model. The contractor selected then makes the sketches and shop drawings he feels necessary to suit his normal fabrication practices. He gets all of his basic information from the model and from written specifications.

Once they become familiar with this approach, contractors feel that it offers them more flexibility, a better picture of the work which their contract covers, and a better understanding of how their work fits in with the other phases. In general, lower lump sum bids are obtained with a model because the contingency is lower.

If proper supervision is available, it is frequently economical to handle the piping installation directly by setting up a well equipped pipe prefabrication shop on the construction site and working close to the model. The model is adaptable to a prefabrication setup, or it can be used right on the site to show design intent to the pipe fitters and allow them to field run the piping.

If the piping is prefabricated, simple sketches are made in the field directly from the model through a combination of scaling and calculation. Normally, a single sketch is used for prefabrication and erection purposes, with the model providing the complete assembly picture.

### Reduce Overall Engineering Cost

The concept of gaining all of the intangible advantages of modeling while reducing the overall engineering cost by the elimination of some of the conventional drawings is real. Although a completed production engineering model, built to our standard scale of $\frac{3}{4}$ in.=1 ft, costs 1 to $1\frac{1}{2}$ percent of the total project cost, a sizable reduction in the pipe engineering cost can be realized. (The cost of field sketching has been included in the pipe engineering cost because it is necessary either with or without a model when piping is prefabricated.)

Modeling has permitted effective contributions by best qualified people in both engineering and operating departments, resulting in better designs for less engineering cost. And, most important, the company finds that its total construction costs are significantly reduced. ∓

NEW OFFICERS of Mechanical Contractors Association of America for 1958-59 are, left to right, William P. Scott, vice president; Horace E. Wetzell, president; Joseph S. Kearney, treasurer

# Mechanical (HPAC) Contractors Defer Action on Merger

***. . . at 69th annual convention. Further and more complete study is to be given consolidation proposal with plumbing contractors, especially to include views of local heating, piping, and air conditioning contractor associations.***

HAROLD E. McGREGOR, left, receives Distinguished Service Award from Joseph C. Fitts, 1957 winner. Award is presented annually to member who has contributed most to the industry and association

ONE of the hottest subjects discussed at the 69th annual convention of the Mechanical (heating, piping, and air conditioning) Contractors Association of America held recently in Los Angeles was a proposal for consolidation of MCAA with the National Association of Plumbing Contractors.

The two associations had been represented by their executive committees in an earlier meeting when a joint resolution was prepared for submittal to the board of directors of each association. This resolution, in revised form, was then presented to and adopted by the members attending the convention.

The resolution suggested that the proposed merger be studied further by representatives of the local affiliated

associations meeting with the MCAA committee to be appointed to handle this with NAPC, and that a report of action of the committee be provided to MCAA members at least 45 days prior to the 1959 convention.

One of the problems encountered in obtaining complete agreement among the mechanical contractors on proceeding with the plans for the consolidation was the preservation of the local identity and autonomy of the two groups in several areas.

Over 700 attended the convention which had been planned with the assistance of the Southern California local association under the chairmanship of T. E. Stice. More than 1200 mechanical contracting firms are members of MCAA.

### Report on Disaster Program

Joseph H. Spitzley, Detroit, president of the association during the past year, reported that the newly formed national disaster relief committee, under the direction of Frank Jenkins, Appleton, Wis., has contributed greatly to the interests of the association by bringing to the attention of governmental agencies and all segments of the construction industry the important part that contracting organizations will play in any national disaster.

The committee offers its services to the appropriate agencies of the Government in disaster planning and disaster relief activities. It will also cooperate with other construction associations and unions in a national disaster relief effort for the construction industry. Educational material on the subject of disaster relief is available from the committee.

### Relax Local Membership

W. R. Stevens, Cincinnati, general chairman of the membership committee, announced that the by-laws had been amended to permit affiliation of local associations with MCAA if two-thirds of their members belong to MCAA. Previously, 100 percent membership was required.

One provision to this revision of the rules is that all officers of the local association must be members of MCAA. The name Mechanical Contractors Association of the city or area represented may be used, but it will have to be relinquished if the local association no longer is a member of MCAA.

This change was made to include the groups of contractors who organized themselves locally and have common local problems. While most of the contractors in these local associations are heating, piping, and air conditioning contractors, some are not, and it was felt by the MCAA membership committee that it would be mutually beneficial to permit membership of these local groups on the basis of two-thirds membership in MCAA under the conditions that were outlined.

The amendment had been considered and approved before the proposed consolidation between the MCAA and the NAPC was studied.

### Harold E. McGregor Honored

The recipient of the Distinguished Service Award for 1958 was Harold E. McGregor, Fitchburg, Mass. This award is presented each year to the member who has made the most outstanding contributions to the industry and to the association. The award was presented by Joseph C. Fitts, consultant to MCAA, 1957 winner.

For the past 12 years Mr. McGregor's efforts and contributions have been both unselfish and distinguished. He was first elected to the board of directors in 1946. In 1947 he was elected association treasurer, and following this he rose to the presidency in 1951. He has also served in many other responsible positions in the association.

### Piping Standards Revised

Leon L. Munier, New York City, representative on the American Standards Association council, reported to the MCAA that during the past year the following standards have been revised:

1) Face-to-Face and End-to-End Dimensions of Ferrous Valves, *B16.10-1957*, revision of Face-to-Face Dimensions of Ferrous Flanged and Welding End Valves, *B16.10-1939*.

2) Steel Pipe Flanges and Flanged Fittings, *B16.5-1957*, Revision of *B16.5-1953*.

3) Specifications for Seamless Copper Pipe, Standard Sizes, *H26.1-1958, ASTM B 42-57*, revision of *H26.1-1956, ASTM B 42-55*.

4) Specifications for Seamless Red Brass Pipe, Standard Sizes, *H27.1-1958, ASTM B 43-57*, revision of *H27.1-1956, ASTM B 43-55*.

5) Specifications for Forged or Rolled Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service, *G17.3-1958, ASTM A 105-57T*, revision of *G17.3-1947, ASTM A 105-46*.

6) Forged or Rolled Steel Pipe Flanges, Forged Fittings, and Valves and Parts for General Service, *G46.1-1958, ASTM A 181-57T*, revision of *G46.1-1956, ASTM A 181-55T*.

7) Specifications for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service, *G37.1-1958, ASTM A 182-57T*, revision of *G37.1-1957, ASTM A 182-56T*.

8) Brass Fittings for Flared Copper Tubes, *B16.26-1958*, revision of *A40.2-1936*.

9) Specifications for Welded Wrought Iron Pipe, *ASTM A 72-56T, ASA B36.2-1958*, revision of *ASTM A 72-55T, ASA B36.2-1956*.

10) Specifications for Electric Fusion Welded Steel Pipe for High Temperature Service, *ASTM A 155-56T, ASA B36.11-1958*, revision of *ASTM A 155-55T, ASA B36.11-1956*.

11) Specifications for Seamless Steel Boiler Tubes, *ASTM A 83-56T, ASA B36.12-1958*, revision of *ASTM A 83-55T, ASA B36.12-1956*.

12) Specifications for Electric — Resistance — Welded Steel, and Open-Hearth Iron Boiler Tubes, *ASTM A 178-56T, ASA B36.13-1958*, revision of *ASTM A 178-55T, ASA B36.13-1956*.

13) Specifications for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Use, *ASTM A 120-54, ASA B36.20-1958*, revision of *ASTM A 120-47, ASA B36.20-1951*.

14) Specifications for Carbon-Steel Castings for Valves, Flanges, and Fittings for High Temperature Service, *ASTM A95-44*, has been withdrawn.

ELECTED DIRECTORS for three year terms are, left to right, Paul C. Downey, John L. Hanson, Austin S. Ford, Leon L. Munier, A. Z. Price. Herman W. Goldner, a sixth member, was not present

He founded his own firm, the Power Piping Corp., Cambridge, Mass., in 1946 after gaining experience in various capacities. During the past year he has served as chairman of the committee on by-laws.

### Name New Officers, Directors

Horace E. Wetzell, president of Smith-Oby Co., Cleveland, was elected president of the association, succeeding Joseph H. Spitzley, president of R. L. Spitzley Heating Co., Detroit.

The new vice president is William P. Scott, president of Scott Co., Oakland. The newly elected treasurer is Joseph S. Kearney, president of Northwestern Heating and Plumbing Co., Evanston, Ill. Lloyd B. Gruman, Jr., New York, was re-elected secretary.

Serving as new board members for three year terms are Paul C. Downey, Milwaukee; Austin S. Ford, Boston; Herman W. Goldner, Philadelphia; John L. Hanson, Minneapolis; A. Z. Price, Charlotte, N.C.; and Leon L. Munier, New York City.

### Washington, D. C., Next Year

The association's 70th annual convention is to be held at the Shoreham Hotel in Washington, D. C., on April 28-May 1, 1959. ≠

# "Bid Shopping Bill Dangerous To Both Contractors, Union"

***. . . Peter T. Schoemann, general president of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry, tells mechanical contractors.***

PETER T. SCHOEMANN, general president of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry, attacked the Federal Construction Contract Procedures Act — better known as the "bid shopping bill" — in a speech before the 69th annual convention of the Mechanical Contractors Association of America.

Mr. Schoemann singled out the bill's "single contract" and so-called anti-bid shop provisions as dangerous to both the union and to contractors.

### Attacks "5 Ft Rule"

He also raised new issues in support of his union's opposition to the so-called "5 ft rule," which would confine mechanical specialty contract work to areas inside buildings and "within 5 ft outside the building line." This clause appeared in the version of the bill approved by the House of Representatives.

Mr. Schoemann said that although "no one ever heard of a 5 ft rule in any part of the heating, piping, and air conditioning construction industry before this, the Atomic Energy Commission is already following this arbitrary rule in letting contracts for installation of $16 million worth of automatic sprinkler systems at three AEC plants in Paducah, Ky.,

***"The Government probably stands to lose as much as anybody."***

Oak Ridge, Tenn., and Portsmouth, Ohio.

"We all know sprinkler systems can be properly installed only with a great deal of care," he explained. "Piping within the 5 ft line must pass a hydrostatic test of 200 psi. It is absolutely impossible to know whether the system is working properly unless the outside work has also been properly put in place. Dirt in the system, carried in from the outside, or a failure in the outside piping can cripple the best inside job.

"No competent piping contractor wants to take responsibility for the inside job without knowing about the outside work as well. The result can be a breakdown in the inside work, endless quarreling as to who is responsible, and maybe litigation to decide who is to blame — in short, one headache after another.

### "U.S. to Pick Up the Check"

"The Government probably stands to lose as much as anybody. After the dust settles down, the chances are good that we will find Uncle Sam picking up the check to correct and pay for the system failure — a failure caused by incompetent contractors and unskilled mechanics getting the job.

"This method of breaking up contracts was being followed more and more by the AEC and by the U.S. Corps of Engineers," he added. "The sprinkler companies tell me that the same pattern is being followed on as much as 20 percent of their private work. In other words, the Federal Government is setting the pace for private industry to follow."

The controversial clause cannot be counted out of the bill, Mr. Schoemann declared, because the House conferees may still insist upon its inclusion, even if the Senate removes it in accordance with an amendment recommended by the Senate Judiciary Committee. He pointed out that the Federal agencies and the Associated General Contractors still consider the House version of the bill as "preferable."

### Expresses Cautious Optimism

Mr. Schoemann was cautiously optimistic about economic conditions in the construction industry from a long range viewpoint. He said there are no indications that the industry can lead the nation back from economic decline, as it did in 1953 and 1954. "While we probably can't be counted on to pull the country out of a slump," he stated, "at the same time we probably won't push it any deeper in the hole."

Reassurance was given the contractors that payments made into joint apprentice training trust funds are legal and are not contrary to provisions of Section 302 of the Taft-Hartley Act. He said the court decision in the Sheet Metal Workers International Association case was not applicable to most of the 8000 joint apprentice committee trust funds in American industry, nearly half of them in the construction field. The legality of such funds has been established, he stated, by the union's own general counsel as well as by "official assurance" from the U. S. Dept. of Labor.

### Pledges UA's Support

He also pledged "every possible effort" on the part of the UA to follow the AFL-CIO policy of increasing efficiency on the job and eliminating wasteful job practices.

"Year in and year out we have been losing millions of dollars worth of work to nonunion contractors because of costly working conditions which we ourselves have created . . .," he admitted. "On a national basis, we could conceivably be on our way toward some hard times with considerable unemployment ahead. Full consideration given to this policy may secure a fat contract for a fair contractor and a union job for a union man."

Mr. Schoemann also commented favorably on the proposed merger of the Mechanical Contractors Association of America with the National Association of Plumbing Contractors. He said, "it should lead the way to greater cooperation between all branches of our industry on matters of common concern than we have ever had before." ≠

17-STORY STRUCTURE houses 195,000 sq ft of rentable floor space, all of which is heated, cooled by perimeter system. Photo was taken during remodeling. Note holes for admitting outdoor air drilled beneath windows on fifth and sixth floors. Window units on floors above have since been replaced. Job took two years to complete

# Fan-Coil System Completes Cooling Of Existing Office Building

BY M. F. STEARN
Vice President
in Charge of Design

and

ROBERT MASAMITSU
Mechanical Engineer

Robert E. Hattis Engineers, Inc.
Consulting Engineers

MODERNIZATION of the 30 year old Mercantile Exchange building, Chicago, included provision for air conditioning the fourth through 14th floors of the 17-story structure.

The top three floors were air conditioned some years ago by means of a central air conditioning system with a capacity of 150 tons. The refrigeration equipment for this system was mounted on the roof.

A similar duct type of system with 65 tons of air conditioning capacity was installed on the second and third floors, and the equipment was located in the third basement. Ground floor commercial tenants and some offices utilized packaged cooling units, and many of the building's 125 tenants used window conditioners previously.

The two central systems still serve the areas for which they were originally designed.

The first three stories are full, with the remaining portion rising in an L shape. The building has 254,-

***30 year old Chicago Mercantile Exchange's $2 million remodeling program included installation of central fan-coil unit type of air conditioning system—augmenting miscellaneous equipment which served building previously. Big reason for selecting this type of equipment is that heating and cooling can be controlled individually, regardless of building exposure. Owners expect system to pay for itself through satisfied tenants.***

857 sq ft of floor space, approximately 195,000 sq ft of which is rentable. Corridors and other facilities make up the remainder.

### Choose Fan-Coil Units

In designing a central air conditioning system for the fourth through the 14th floors, it was decided on the installation of a split system. A primary reason for selecting the fan-coil unit type of system was the individual control of perimeter heating and cooling, regardless of exposure, which this equipment makes possible. Each of these units is equipped with units, utilizing hot water for heating multispeed fan controls. Fan-coil and chilled water for cooling, were installed over a two year period with minimum disturbance to normal operating procedures of tenants.

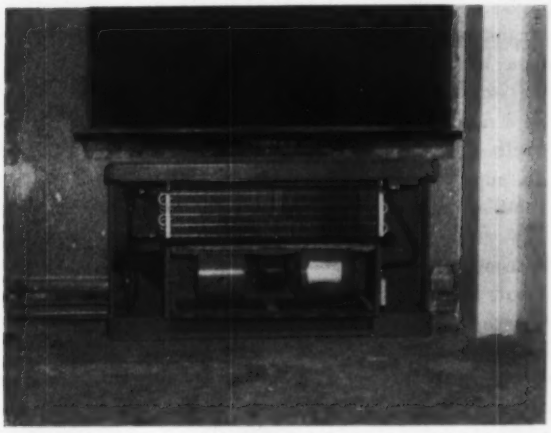
Existing boilers were found to be of sufficient capacity, so no additional facilities were required other than the installation of a converter to provide hot water instead of steam. These boilers are coal fired.

### 650 Tons of Cooling Capacity

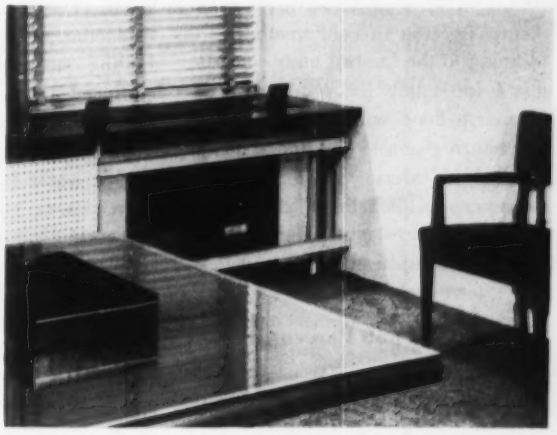
For the fan-coil installation, 650 tons of air conditioning capacity was required. To provide chilled water for the cooling cycle, two refrigeration units, 300 and 350 tons, respectively, were installed in the basement. The chillers reduce the water temperature from 60 F to 48 F.

Circulation for both hot and cold water is provided by two 1200 gpm horizontal end suction pumps which were part of the old system. The pumping system was installed in two phases of 300 and 350 tons. Pumps were sized for maximum quantity, and the impellers were changed when the entire system was completed. No additional pump facilities have been required.

For compressor cooling, two steel cooling towers which are capable of delivering 900 gpm each are located on the third floor roof. Design conditions call for cooling the water from 95 F to 85 F with air at 76 F wet



CONDITIONERS utilize hot water for heating, chilled water for cooling. Units have provisions for admitting 25 percent outdoor air during both cycles. Existing steam boilers supply hot water through conversion. Two refrigeration machines, rated 300 and 350 tons, respectively, meet cooling needs



COMPLETED JOB has units installed unobtrusively, consistent with office decor. 522 such units are located on fourth through 17th floors. System maintains 75 F, 50 percent RH when outdoor temperature reaches 95 F; 74 F when outdoor temperature drops to −10 F design low

bulb. Water is pumped through the condenser and to the tower through 8 in. piping, with gravity return to the header.

### Admit 25 Percent Outdoor Air

Except for two ceiling models, all of the 522 console fan-coil units in the installation serving the fourth through 17th floors are mounted at the building's perimeter. The ceiling models and 75 of the console models are 2/3 ton units. The remaining units are all rated at 1½ tons.

The units all have provisions for introducing 25 percent outdoor air during both the heating and cooling cycles. This outdoor air is introduced through a 5 in. diameter hole which has been core drilled into the masonry wall behind each unit. The air intake consists of an aluminum tube and louver covered on the outside by a screen. Control of the amount of outdoor air to be introduced is accomplished through use of a manual damper which is locked in position.

Outdoor air enters the conditioner itself through a 2 in. deep plenum created at the rear of the unit through use of 1½ in. metal strips secured to the enclosure and ⅝ in. sponge rubber insulation between the conditioner and the wall.

The outdoor air damper can be closed in cold weather if desired. Design conditions calling for constant circulation of hot water during the heating cycle is an added precaution against freezing in cold weather.

Piping to the fan-coil units consists of a 6 in. supply and return loop at the fourth floor, with 2½ in. supply and return risers to the upper floors installed in exterior columns. Lines are covered with 1 in. of glass fiber insulation. Sleeve type single expansion joints compensate for expansion.

### Maintain 78 F, 50 Percent RH

The fan-coil units are designed to maintain indoor conditions at 78 F dry bulb and 50 percent relative humidity with summer outdoor conditions at 95 F DB and 75 F WB. Provisions called for a 48 F entering water temperature with a 12 F temperature rise. Due to internal heat gain, cooling is provided in many spaces when outdoor temperatures are as low as 50 F.

For heating, design conditions are −10 F outside while maintaining a 74 F inside temperature. Hot water design temperature is 135 F entering, with a 12 F deg drop.

During shutdowns or when spaces are not occupied, time lapse meters activate fans to maintain a minimum temperature. Hot water is circulated constantly. Balancing cocks are installed on return runouts for balancing the system.

Transition from one cycle to the other is accomplished through a pneumatic summer-winter control. A further refinement includes a master outside thermostat for the winter cycle. At −10 F, the water temperature at the coil is 210 F; at 60 F the water coil temperature is 125 F.

During freak changes of weather which might call for morning heating and afternoon cooling, special provisions are taken to cool heated water by means of a water-to-water precooler before the water enters the choke. For this operation, condenser water is used as the cooling medium in the precooler.

### Ventilate Interior Zones

In addition to the fan-coil equipment, air handling units are installed on alternate floors to serve interior zones. These units are set for introduction of 25 percent outdoor air. Ceiling suspended, these units are equipped with vibration isolators to keep operating noises to a minimum.

They are supplied with hot and chilled water from 4 in. supply and return risers. The air handling equipment is controlled by three-way valves regulated by aquastats in the mixed air plenum. Where temperatures are critical in interior zones, outdoor air introduction can be regulated and provisions made for reheating air.

### Install All New Piping

All piping for the system was new, the old lines being left in the columns. The main difficulties encountered in the installation were reallocation of space and location of new equipment to conform with existing conditions, piping, and ductwork.

Piping was run to meet existing conditions. Some difficulty was met here, since the existing piping had to be in operating condition until such time as the space it served was remodeled.

Also presenting a problem was where to put the outdoor air intakes for the perimeter units. Steel beams at various points in the wall through which holes were drilled made it necessary to relocate the intakes. To solve this problem a special plenum was devised which allowed for varying heights of the intakes.

A service company is retained by the building to provide maintenance for the entire system. Special filter frames with precut filters for periodic changes are used for the fan-coil units. Spare blower motor units are stocked for ready replacement. Any unit can be shut off for repair or servicing without evidence of pressure buildup.

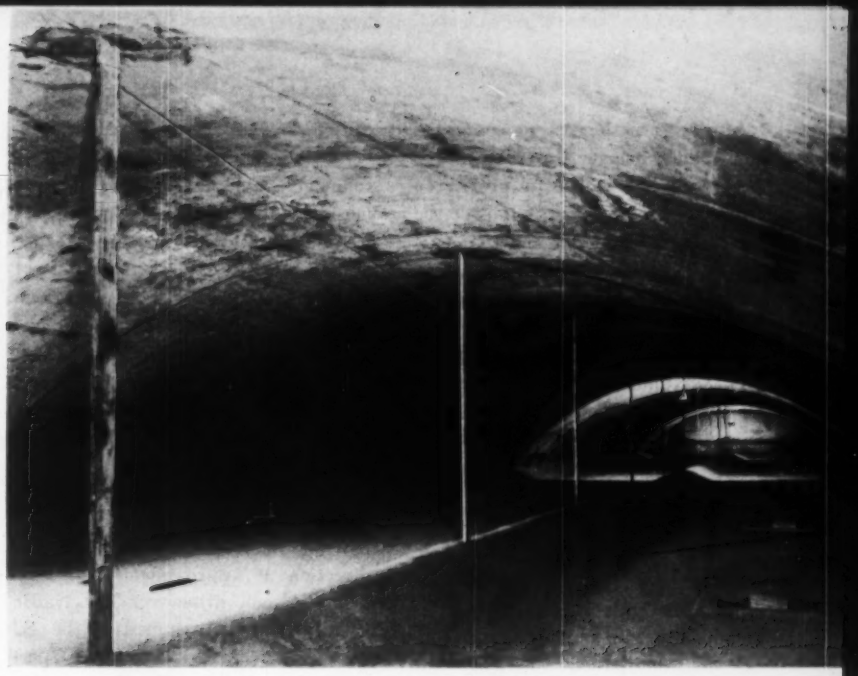
### System to Pay for Itself

The building management has found the system to be completely satisfactory. There have been minor adjustments in the balancing of the system necessary, but a minimum number of complaints have been received from tenants. The cost of adding air conditioning and modernizing the heating system was 71.5 cents per sq ft of rentable space. This will be paid for by tenants through an increase in rent rates.

The system has been in operation during one heating season and one cooling season. As soon as sufficient operating data is collected, another article about the operation of the system will be presented.

The consulting engineer for this installation was Robert E. Hattis Engineers, Inc. The mechanical (heating, piping, and air conditioning) contractor was Advance Heating and Air Conditioning Corp. ∓

*Photos Courtesy Modine Mfg. Co.*



VEHICULAR TUNNEL is twin tube structure, with each tube accommodating two lanes of traffic. Construction view right shows ventilation air supply outlets in roadway. Today, under normal maximum operating conditions, outlets admit more than 3 million cfm of outdoor air to tunnel

# "Transverse" Tunnel Ventilation Assures Uniform Air Distribution

***Baltimore Harbor Tunnel is ventilated by method which eliminates longitudinal flow in driveways. Two huge fan installations, via supply and exhaust ducts, force outdoor air into and remove vitiated air from 1.4 mile under-river roadway. Specifications required that contractor back up his installation by guaranteeing that annual power consumption not exceed fixed amount.***

BY H. G. CRUTHERS
Mechanical Engineer
Singstad & Baillee
Consulting Engineers

THE Baltimore Harbor Vehicular Tunnel, under the Patapsco River between Canton and Fairfield in Baltimore, was built by the State Roads Commission of Maryland to break one of the nation's worst traffic jams. To handle an anticipated 18 million cars per year, very careful consideration had to be given to the design of the ventilating system which must carry off the exhaust fumes from this tremendous volume of traffic.

The tunnel is 9215 ft in length between grade points. From portal to portal it is 7650 ft long, of which 6300 ft comprises the underwater tunnel. The twin tube structure provides for four lanes of traffic. Each tube has a roadway width of 22 ft between curbs and a sidewalk approximately 2 ft, 8 in. wide.

Two construction shafts, which are used for ventilation, are approximately 6384 ft apart — one on the Canton side and the other on the Fairfield side. The underwater tube is joined to these shafts on each side of the river.

Between the shafts are 21 tunnel sections, each 300 ft long and constructed of steel shells and reinforced concrete. These were floated into place and sunk on a previously prepared sand bed in a dredged open trench.

After the sections were connected and made nearly water-tight, the trench was backfilled to provide a cover of not less than 10 ft over the tunnel. The profile of the tunnel is such as to provide a shipping channel depth of 50 ft from low water to cover. The lowest point in the roadway is about 89 ft below mean sea level. Maximum roadway gradient in the tunnel and open ramps is 3.5 percent.

### Dilute Auto Exhaust Gases

Studies show that the carbon monoxide content in exhaust gases of various individual vehicles varies from 0.5 to 14.0 percent. In designing for ventilation, the engineers were primarily interested in the quantity of carbon monoxide and smoke discharged by the various classes of motor vehicles under the appropriate speeds and grades for the tunnel.

It was decided that a positive mechanical system of ventilation be installed which would provide for the introduction of enough outdoor air to the driveways to dilute to a safe degree the exhaust gases given off by the vehicles and to remove the vitiated air from the driveway as quickly as possible.

It has been found that if the air in the driveway of a vehicular tunnel contains not more than 2.5 parts of carbon monoxide in 10,000 parts of air, the traveling public as well as men working in the tunnel will be entirely safe and free from injurious effects of carbon monoxide and the tunnel atmosphere will be free of smoke.

Samples of the vitiated air are continuously analyzed by carbon monoxide detectors which make a continuous visual record.

Four analyzers are used, one for each section of the tunnel. The results of the analyses are continuously recorded on charts in the control room. Incorporated in each recorder is an alarm which is set to notify the operator if the carbon monoxide content exceeds 2.5 parts in 10,000 parts of air.

The quantity of outdoor air required to ventilate any section of a vehicular tunnel depends on the following factors: (1) the dilution necessary to render the exhaust gases harmless and to insure safety, health, and comfort; (2) the amount of carbon monoxide and smoke given off in the exhaust from motor vehicles; (3) the number and classification of vehicles; (4) the speed and spacing at which the vehicles are traveling; and (5) the grades on which they are operating.

Normal ventilation requirements are based on 3000 vehicles per hr moving in two lanes in the same direction at approximately 20 mph through each driveway. The traffic classification is assumed to be 80 percent passenger cars and 20 percent trucks and buses.

### Adopt Transverse System

The ventilation system adopted for the tunnel is that which has become known as the *transverse method of ventilation*. This type of system has been used on other major vehicular tunnels of comparable length and has proved to be very satisfactory from a ventilating as well as an economic standpoint.

This method eliminates all longitudinal flow of air in the driveway except that which is induced by the moving traffic. Outdoor air is supplied to the driveway through uniformly spaced flues which connect the air supply ducts, located under the roadway, with the driveway. The supply ducts extend longitudinally under the roadway between the ventilation shafts.

Outdoor air enters the driveway where it dilutes the exhaust gases. This vitiated air is then drawn up into the exhaust air ducts by means of uniformly spaced ports set in the ceiling slab which comprises the lower side of the exhaust air duct.

Each of the twin tubes is divided longitudinally by an air duct bulkhead. One is located in each supply and exhaust duct—making four ventilation sections for the entire tunnel.

Thus there are four outdoor air supply ducts and four exhaust air ducts. Each supply duct is connected to four supply fans. Likewise, each exhaust duct is connected to four exhaust fans.

Eight supply fans and eight exhaust fans are located in each of two ventilation buildings—one in Canton and the other in Fairfield. These fans provide the ventilation to their respective halves of the tunnel.

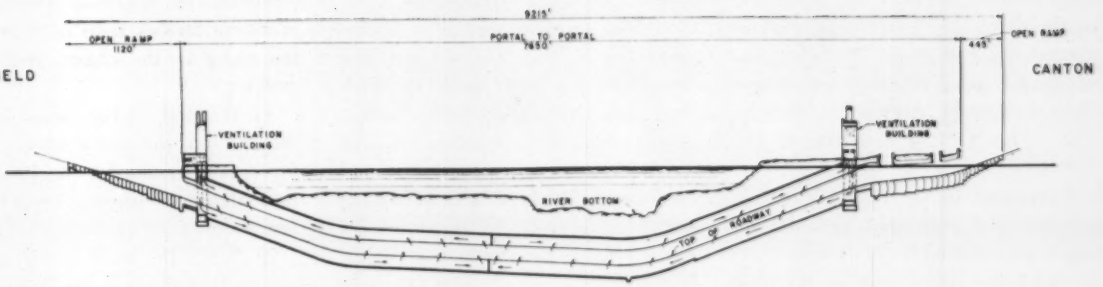
### Select Air Flow Rates

The power required to ventilate a vehicular tunnel depends on the volume of air to be supplied and the pressure necessary to move the air to the place it is required. The total volume of air required to ventilate a given length of tunnel depends on the rate of air supply per foot of tunnel and the length of the sections. The pressure required to move the air depends on the volume of air and the physical characteristics of the air passages or ducts. Large air ducts are desirable. Elbows and abrupt expansions or contractions are to be avoided as much as possible.

Since the structure of the tunnels is a twin tube, the profiles and lengths of roadways for each driveway are identical. The maximum grades are 3.5 percent and the minimum grade is 0.5 percent. The area of each outdoor air duct is 105.4 sq ft, with a hydraulic mean radius of 2.26. Each exhaust air duct is 108.52 sq ft in area, with a hydraulic mean radius of 2.18.

Locations of the air duct bulkheads were established to balance as nearly as possible the fan brake horsepower and to limit the sizes of the motors.

All entrances and exits are on the 3.5 percent grades. These grades are joined by the 0.5 percent grade which provides drainage to a low point or sump common to both tunnels. Outdoor air at 300 cfm per ft of roadway is provided on the upgrade section of each tunnel. Downgrade sections are supplied with 155 cfm per ft. On the ascending grade of 0.5 percent in the west tunnel an outdoor air supply rate of 245 cfm per ft of tunnel is provided. On the descending 0.5 percent grade in the east tunnel 1220 cfm is supplied.




TUNNEL PROFILE (schematic) illustrates how each half of tunnel is ventilated. Note bulkheads in ducts at approximate midway points. System can easily accommodate 3000 vehicles moving through each of two roadways

Air duct bulkheads for both the supply and exhaust ducts are located in the 0.5 percent grade section.

At the Fairfield side of the tunnel, the ventilation building stands directly over the shaft so that the air ducts from the fans to the tunnel ducts are downcast. These ducts are constructed with a minimum number of elbows, turns, and changes in size.

The southerly half of the tunnel is ventilated from this point. The east and west sections respectively, are each served by four supply and four exhaust fans.

At the Canton side it was necessary to offset the ventilation building about 250 ft from the shaft in order to minimize interference with the Canton Railroad tracks. This location imposes additional pressure losses on the fans due to additional elbows and friction losses in the 250 ft of straight run between the ventilation building and the tunnel ducts.

The building ventilates the northerly half of the tunnel in the same manner as the Fairfield installation serves the southerly half. Three of the fans connected to each air duct, when operating at full speed, furnish the normal maximum ventilation requirements. The fourth fan stands by as a spare. When all four fans are operating at full speed on each air duct, about 110 percent of normal maximum ventilation requirements are provided.

Each fan is directly connected by means of a flexible coupling to a large squirrel cage induction motor which drives the fan at its full speed of 509 rpm. A smaller, two-speed, two-winding squirrel cage induction motor is connected to the extended shaft of the large motor by means of a silent chain transmission in a dust-tight and oil-tight casing. The smaller motor (1200/600 rpm, synchronous speed), through reduction, drives the fan at 339 and 169 rpm. Each large, single speed motor is rated at 450 hp, and each smaller unit is 128.36/16.16 hp.

Table 1 lists the number of outdoor air supply and exhaust fans, together with the section of the tunnel to which they are connected, the building in which they are located, the volume of air delivered by each fan, and the static pressure against which they are working when three fans are operating at maximum speed on each air duct.

TABLE 1—SUPPLY, EXHAUST FANS listed according to location, duct section served, volume of air handled by each fan, static pressure against which they are working when three units are operating at full speed on each duct

| Location | Serving tunnel duct section | Type of system | Total Fans per duct | Air volume per fan, cfm | Static pressure, in. WG |
|---|---|---|---|---|---|
| Fairfield | West | Supply | 4 | 275,000 | 6.25 |
| | West | Exhaust | 4 | 262,000 | 7.375 |
| | East | Supply | 4 | 250,000 | 8.375 |
| | East | Exhaust | 4 | 244,000 | 9.0 |
| Canton | West | Supply | 4 | 226,000 | 7.625 |
| | West | Exhaust | 4 | 229,000 | 8.5 |
| | East | Supply | 4 | 275,000 | 7.375 |
| | East | Exhaust | 4 | 264,000 | 8.0 |

TABLE 2—THREE-SPEED FANS capable of operating individually or in parallel afford 10 rates at which ventilation can be supplied. To accomplish this, fans must run at same speed

| Fan speed step | Fans operating on each air duct | Approximate percent of normal maximum ventilation supplied | Approximate number of vehicles per hr per tunnel for which ventilation is provided | Approximate kw input to all motors operating |
|---|---|---|---|---|
| Low | 1 | 16.0 | 480 | 81 |
| | 2 | 27.0 | 800 | 188 |
| | 3 | 33.3 | 1000 | 292 |
| | 4 | 37.0 | 1100 | 374 |
| Intermediate | 2 | 53.5 | 1600 | 1399 |
| | 3 | 66.6 | 2000 | 2182 |
| | 4 | 74.0 | 2200 | 2850 |
| High | 2 | 80 | 2400 | 4721 |
| | 3 | 100 | 3000 | 7344 |
| | 4 | 110 | 3300 | 9418 |

## 24 Fans Meet Normal Needs

Twelve supply and 12 exhaust fans operating at full speed meet the normal maximum ventilation requirements. Under this condition about 3,078,000 cfm of outdoor air is supplied and 2,997,000 cfm of vitiated air is exhausted.

The difference in volumes is the amount of outdoor air provided for the short upgrade sections between the shafts and the portals where there are no air ducts. The excess of the air supplied over that removed moves

longitudinally through the driveway in the direction of traffic movement towards the exit portal. These lengths of tunnel ventilated by the longitudinal method are approximately 252 ft for Canton and 186 ft for Fairfield.

Variations in the volumes of air supplied and exhausted in order to meet the demands of traffic are accomplished by changing the fan speeds and the number of fans operating on any section. Each fan can be operated at one of three speeds: low, medium, or high.

### 10 Ventilation Rates Available

Four fans connected to each air duct and capable of operating at any one of three speed steps individually or in parallel afford 10 economical steps or rates at which ventilation can be supplied—provided that all fans which are operating on that duct are running at the same speed.

Table 2 indicates the number of fans operating, the speed at which they are running, the percentage of normal maximum ventilation provided, the approximate kilowatt input to the motors, and the number of vehicles which can be passed through each tunnel during one hour for which ventilation has been provided.

All fans are of the same geometric design, and are of the full-housed, double-inlet, horizontal centrifugal type. Their backwardly curved, non-overloading, centrifugal wheels have hollow sectioned, aerodynamic shaped airfoil blades. All supply fans are downblast, while the exhaust units are upblast.

Dampers between fans and air ducts are of the single leaf type, raised and lowered by roller chains from an overhead shaft actuated by a motor driven self-locking gear reducer. The motor also is supplied with an electric brake. The dampers are automatically opened when the fan is started and closed when it is shut down.

### Guarantee Power Costs

The Baltimore Harbor Tunnel is in continuous operation 24 hrs per day. Ventilation requirements vary, of course, with the volume of traffic using the facility at any time. The equipment to meet these demands must be dependable, easily adaptable to variations in capacity, efficient over a wide range of capacities, and economical in first and operating costs.

To obtain the most economical installation, a comparison of proposals was made on the basis of the lump sum price for furnishing and installing the ventilation equipment, plus the cost, reduced to present value, of the guaranteed annual consumption of electrical energy during the probable lifetime of the equipment.

The specifications also required that the bidder guarantee that the annual consumption of electrical energy of the equipment he proposed to furnish and install would not exceed a fixed amount. This was determined by him, based on a specified schedule of fan operation.

### Conduct Performance Tests

In order to verify the fan performance curves submitted by the bidder and the power input to the fans when delivering the required volumes of air against the pressures stated in Table 1, the contractor conducted performance tests on a model geometrically similar in design to the fans he proposed to furnish.

The unit was tested both as a supply and as an exhaust fan. In the latter test it was set up in an exhaust fan chamber which was geometrically similar to the actual fan chamber in which the exhaust fans are located in the ventilation building. This test was conducted in order to take cognizance of the spin of the air in the fan chamber before it entered the fan inlet.

Complete shop tests were conducted on the motors to determine the power input when driving the ventilating fans.

The results of the fan and motor shop tests were used to verify the contractor's warrantees as to annual electrical input and guaranteed cost of operation. In calculating the consumption of electrical energy the following factors were used to cover the losses in the chains and idling motors:

1) When the large motor is driving the fan, the motor output horsepower was assumed to be 105.9 percent of the horsepower input to the fan.

2) When the small motor is driving the fan through the large motor (by means of the chain transmission) at two-thirds fan speed, the motor output horsepower was assumed to be 104.7 percent of the horsepower input to the fan at that speed.

3) The motor output horsepower was assumed to be 109.3 percent of the horsepower input to the fan at one-third speed when the small motor was driving the fan through the large motor at that speed.

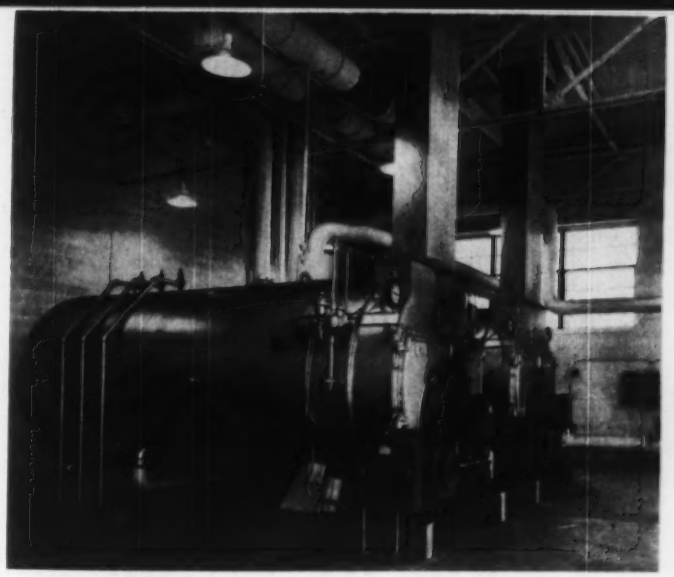
Test results, in conjunction with the efficiency ascribed to chain and idling motor losses, showed that the efficiency of the ventilating equipment furnished was about 1.01 percent greater than was guaranteed.

The low bidder bid $954,534 for furnishing and installing the fans, motors, and transmissions. His guaranteed cost of the annual consumption of electrical energy (reduced to present value) was $973,852.17. In arriving at this guaranteed cost the life of the equipment was estimated to be 30 years (at a 3 percent interest rate) and the cost of power was figured at $0.017315 per kwhr.

Power to operate the ventilating equipment as well as lights, pumps, and auxiliaries is supplied by the local power company. Three feeders enter the Canton side of the tunnel and one enters the Fairfield side, with tie connections between the two.

A central control station is located in the Fairfield service building. From this point the system is controlled by operators who have before them a continuous record of the air conditions in the tunnel as well as devices which inform them of traffic conditions in the tunnel.

The Baltimore Harbor Tunnel was opened to traffic November 30, 1957, at 12:01 a.m. In continuous service since then, the ventilating system has proved to be entirely satisfactory. ⧺



BOILER PLANT comprises two No. 5 oil fired packaged boilers. Units supply 260 F water to forced circulation system. Minimum maintenance requirements of hot water boilers influenced selection of HTHW

# Design for Flexibility to Serve Plant's Heating, Cooling Needs

***Combination warehouse and office is heated by six zone high temperature hot water system. Two packaged boilers supply 260 F water which is circulated to unit heaters, convectors. Offices, cafeteria are air conditioned year 'round by separate direct expansion system.***

BY E. H. ROPER
Chief Mechanical Engineer
A. Bentley & Sons Co.

THE DESIGN of heating and cooling for a building with diversified activity is naturally complex. Such was the case with the systems installed at the Toledo warehouse and office of the Dana Corp., manufacturer of automotive parts.

The facility consists of a 115,200 sq ft warehouse with a shipping and receiving area, a large general office space, and an employee cafeteria. All office and cafeteria space is provided with year 'round air conditioning. The warehouse is entirely on one floor except for a space 200 ft × 40 ft which is 12 ft above the first floor and is used as a packing area for small parts.

It was decided to install a high temperature hot water system for the following reasons:

1) Low first cost
2) Low operating cost
3) Small amount of maintenance required
4) Flexibility of operation to meet various building requirements.

The heating system is divided into six zones of two to five unit heaters each. Each zone is controlled by an air diaphragm valve which is

AIR CONDITIONING equipment room houses two hermetically sealed compressors (one of which is at left), evaporative condenser (behind compressor), multizone unit (right). Direct expansion system cools office, cafeteria spaces

actuated to close when all of the unit heater thermostats are satisfied. This permitted the elimination of pipe insulation, since the piping in any zone is heated only when there is heat needed in that zone. The mains are insulated, however.

Connections to the unit heaters are made with metallic hose. Where necessary, orifice type unions are used to equalize flows.

All six zones are controlled by a program type of time switch so that any or all of the zones can be shut down at night. Unit heaters are individually controlled by means of mercury bulb thermostats with locking devices and wire guards.

### Throttle Office Convectors

Offices are heated by convectors with copper tubes and aluminum fins. It would be difficult to control the heat output of these convectors if the 260 F water were admitted and were throttled or controlled by on and off control. This would be especially difficult as most of these convectors are piped in series in a given heating zone. Therefore, dampers are provided on all convectors, except in the room containing the thermostat, so that each occupant can throttle the heat output to meet individual requirements.

It would be even more difficult to control the heat output of the heating coils in the air conditioning system. When coils are sized for both heating and cooling, they require water temperatures of about 115 F maximum.

Instead of using heat exchangers and a separate system for each of these zones, a small pump is used for circulating the water through the heating coils. A small amount of water is allowed to leave the zone through a modulating diaphragm operated valve to the return system and then to the boiler. This water is replaced by 260 F water from the supply side of the system, the connection for which is left open at all times.

Air vents are provided at unit heaters, coils, etc., but these consist only of nipples with reducing couplings and manually operated gate valves. It is expected that all air will be collected at the expansion tanks after the system has been initially started.

The method used for connecting the boilers to the system will cause any air released to be forced into the expansion tanks. Connections to the expansion tanks are made in such a way that air is not absorbed from them.

### Prevent System from Boiling

Pumps are connected to the discharge sides of the boilers so that the static head necessary to prevent the system from boiling at 260 F is 48 ft and the pump head is 92 ft. By connecting the expansion tanks to the system in this manner the pump suction is kept at a uniform positive pressure, thus eliminating troubles caused by cavitation.

Main pumps are rated 450 gpm at 92 ft each. They are driven by 15 hp, 3450 rpm motors. These pumps have water cooled bearings and water cooled mechanical seals. A tight system is especially important as make-up water brings air and corrosive gases and dissolved minerals into the system.

A control is used to prevent these pumps from operating unless there is a flow of cooling water through the seals and bearings. One pump is operated at a time. Water temperature is controlled by an outdoor shaded bulb thermostat.

Since the small circulating pumps are not required to handle water at temperatures higher than 200 F, they are equipped with ceramic mechanical seals without water cooling.

### Control Offices Individually

The executive office area is arranged with private offices along the outside wall. To give the occupants of these offices individual control of both heating and cooling, each 20 ft bay is equipped with two units located below window sills.

Supply and return lines for these units are installed below the floors and are covered with a granular type of insulation. Air supply is from the multizone unit and electrostatic filter through sheet metal ducts encased in concrete also located below the floor.

Interior zones are heated or cooled by diffusers supplied through ductwork. Air is returned through the space above the ceiling. This makes insulation on the supply ducts unnecessary.

### Use Direct Expansion System

Cooling is accomplished by direct expansion coils in multizone units. The refrigerant is compressed by two hermetically sealed units and an evaporative condenser. Air is filtered by an electrostatic filter.

By means of bypass dampers, 100 percent outdoor air may be introduced into the conditioned space when the compressors and condenser are shut down. These dampers will also make the interior zones habitable should there be an equipment failure. Separate refrigerant circuits are provided for each compressor through the evaporative condenser and coil so as to minimize the possibility of a shutdown due to a refrigerant leak.

Since the shipping and receiving offices are located at some distance from the equipment serving the main office, 5 ton package units condition each of these spaces.

### Provide Warehouse Ventilation

Two sides of the warehouse are enclosed by ventilated sash. The warehouse area, however, is blanketed on two sides by the offices, boiler room, and shipping and receiving dock.

The areas near the center of the building would not receive adequate ventilation were there not motor driven fan units installed on the roof which remove air from the building. These units are equipped with dampers which are opened manually or automatically when the fan motors are started. The dampers are also equipped with fusible links and weights so that they will open wide in case of fire. Outdoor air enters the building through the ventilated sections in the outside sash. ≠

# Condition Jail for Health, Security

***Air conditioning affords maximum security to new Jacksonville, Fla., jail by permitting 460 prisoners to be confined in windowless cells. Adjacent courthouse is conditioned, too. Both buildings are cooled by 1200 ton plant.***

AN AIR CONDITIONED county jail may be rare, but the sound reasons of health and security have made this rarity a reality in Jacksonville's recently completed $8 million Duval County courthouse and jail.

Says Burt J. Saymon, air conditioning engineer of Reynolds, Smith & Hills, architects and engineers for the buildings: "When you get 460 prisoners confined in one building there is a health factor to consider—especially during Jacksonville's warm summers. Through air conditioning it is possible to provide inside cells with no windows, thereby making escape virtually impossible."

The courthouse building, with seven floors including a mezzanine, and the five-story jail building contain a total of 440,000 sq ft of floor space. The two buildings are connected only by two enclosed corridors at upper floor levels which bridge an intervening street. One corridor is used to take prisoners to and from court rooms, while the other is for authorities and others having business in the jail.

The east and west walls of both buildings are windowless. Vertical sun control is on the north face and vertical and horizontal control is on the south. This is provided by a precast concrete overhang and vertical fins placed 3 to 4 ft apart on the north face. On the south face every window also has a horizontal overhang.

The 1200 ton refrigerating plant is composed of three 400 hp centrifugals, two of which serve the courthouse and one the jail. Together, these circulate 3600 gpm of chilled water.

The equipment room, containing the units necessary for both cooling and heating, is situated on the ground floor of the courthouse. A five-cell cooling tower is recessed on the roof and has a capacity of 4200 gpm of condenser water.

The heating plant consists of two 200 hp hot water generators for the courthouse and one 80 hp steam generator for the jail.

In the two buildings there are 223 zones of control. Forty multizone units serve the low pressure side of the system, while the perimeter is conditioned by a high pressure induction system utilizing under-window units. Interior spaces are served by the low pressure multizone system. Judges' chambers are conditioned by a dual-duct system.

This type of system makes possible the simultaneous cooling and heating of different parts of either building, a feature which is expected to be of great value in the spring and fall.

The first floor and mezzanine of the courthouse are built as a vault, with no windows, thus effecting a saving in air conditioning and reducing the work of having to move records into small vaults at night.

A central outdoor air system draws air, at 95,000 cfm, through a duct into the main equipment room, where it is cleaned, dehumidified, and preheated or precooled. It is then conveyed under pressure to the air handling rooms. This arrangement has resulted in a saving in the size of coils and in equipment space.

In the main equipment room a control board with 102 indicating and recording instruments records the temperatures in the major zones, enabling the operator to change the cycles from that point. The courthouse system can be shut down on weekends without disturbing the jail system. Temperatures in the jail can be regulated by the guards at control points in the corridors.

The two buildings are protected by a heat and smoke detection system which is interlocked with the central Jacksonville fire station. The jail has a photo-electric system which is tied in with the air conditioning system so that the latter shuts off automatically if fire breaks out.

The mechanical (heating, piping, and air conditioning) contractor was Henley & Beckwith, Inc. ∓

TO KEEP AIR CONDITIONING SYSTEMS OPERATING—

# Combat Tower Water Dirt Buildup

***Many years can be added to the service life of an air conditioning system by adhering to some basic housekeeping principles. Tower water is bound to get "dirty," and water treatment cannot prevent accumulation of dirt and other solids. The only way to correct this condition is manually—by performing certain steps before system startup, during the cooling season, and after shutdown. These steps to uninterrupted service are listed on the next page.***

BY H. L. SHULDENER, JR.
Water Service Laboratories, Inc.

MANY OWNERS of air conditioning installations that include water saving devices such as cooling towers and evaporative condensers have two service contracts — one for mechanical and electrical maintenance, and the other for water treatment to protect the equipment from corrosion, scale, and slime formation. Even with these services, however, there is still a missing link in the proper care of equipment, and that is the attention that the owner must supply in the form of some basic housekeeping.

### Dirt Scrubbed from Air Clogs Equipment

The condenser circulating water, when sprayed through air, washes out of it not only acidic gases which cause the water to become corrosive, but it also scrubs out dirt, soot, fibers, etc., which are present in the atmosphere. If an excessive amount of these solid materials is allowed to accumulate in the collecting pan of the cooling tower or evaporative condenser, it may work its way past strainers and into the rest of the water circulating system and cause partial or even complete clogging of pipes and condensers.

The dirtier an air conditioning system is, the more favorable are the conditions for the growth of slime and algae. Sometimes bacteria may grow and a slime condition may develop, leading to the same clogging as the accumulated dirt can cause. Chemical control of slime formation, to be effective, must be combined with extensive periodic cleaning operations.

In addition to the clogging action, particles of dirt or slime can coat the insides of pipes or tubes and thus act as insulators on heat transfer surfaces. Also, this buildup of material may form an undesirable separating layer between metal surfaces and any corrosion inhibitor that may have been fed into the circulating water. This will tend to partially defeat the purpose of the chemical treatment.

### Don't Wait Until Chemical Cleanout Is Necessary

There is nothing which can be added to water that will prevent the accumulation of dirt and other solid materials. This must be done manually. It is true that there are detergent chemicals which can make the job of removing these deposits easier by loosening and placing them in suspension so that they can be more readily flushed out of the system, but the system should not be permitted to reach the point where shutdown for such chemical cleanout becomes necessary.

A check list guide to good housekeeping is presented on the next page. A mechanical service contract will cover many of these items, but they are included here in order to be as complete as possible in alerting the reader to everything which may be a source of trouble and which cannot be prevented by water treatment.

Water treatment only protects those parts of a system submerged in the water or kept continuously wet by the sprays. Actually, water treatment is designed primarily to protect those parts of a system through which the water passes after leaving the cooling tower. The protection that the cooling tower or any spray chamber receives from chemical treatment must be supplemented by the attention described in the check lists. Of course, by keeping the spray equipment clean, the chances of trouble from the entire water circulating system can be minimized.

By reasonably adhering to these suggestions and by making use of carefully controlled water treatment, many years of uninterrupted service may be added to an air conditioning system. This is the only correct way to insure proper functioning of the system, free of the many headaches which can be caused by water.

# Through Good Housekeeping

### I — Before Startup

*What to do before system startup:*

1) All pans and interior surfaces of cooling towers should be hosed down and flushed out to remove airborne grime that has accumulated during the winter. This should be done before the system is filled with water. If no convenient hose connection is available, it would be desirable to provide one.

2) Float valve or ball cock should be adjusted to close completely when the water level in the collecting pan is about 1 in. below the point of overflow. There should be no overflow when the sprays are on and the ball cock should close tight when the sprays are off. The discharge of the valve or cock should always be above the water level in the collecting pan.

3) Pump packing should permit only enough water leakage for lubrication, and should not allow an excessive amount of water to run to waste. Check manufacturers' recommendations, and adjust or replace the packing as necessary.

4) Spray nozzles, perforated head pans, and strainers should be inspected and cleaned, if necessary.

### II — During the Season

*Check list for use during the cooling season:*

The environment of the equipment is an important factor in determining how fast airborne solid material will accumulate in the system. All of the items on the following list should be checked weekly, but after a time experience will dictate how often most of them will actually need attention.

1) Check nozzles and head pans. Keep them clean to avoid clogging.

2) Clean strainers and screens, if necessary.

3) Keep pump packing adjusted.

4) Prevent vortex at outlet of cooling tower pan to avoid air being sucked into the system. Adjust water level or install baffles, if necessary.

5) Check ball cock adjustment.

6) Inspect bottom of collecting pan. If dirty, drain and flush.

7) Inspect interior of equipment for slime. If found, call service company.

8) Hose down all loose deposits on eliminators of spray equipment and wood fill of cooling towers.

### III — After the Season

*What to do when laying up system for the winter:*

1) Float valve or ball cock should be taken apart, cleaned, and rewashered.

2) Flushing and cleaning: Pans, pipe lines (including bleed and overflow lines), pumps, and heat exchange equipment should be drained and flushed. Perforated head pans and spray nozzles should be laid up in a clean condition. Normally, water circuits are left empty, but if it is desired to keep them partly filled with treated water over the winter to prevent corrosion, all precautions should be taken to prevent freezing. Before spring startup, water circuits should be thoroughly drained and flushed.

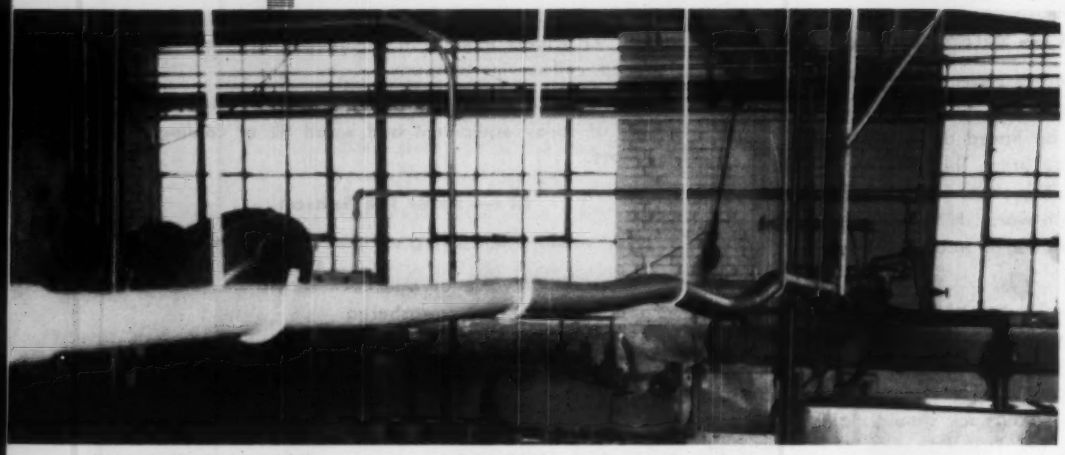
3) Strainers and screens should be removed and cleaned, and re-installed when layup work has been completed. Strainer baskets at the pumps should also be cleaned.

4) Refrigerant condensers: Where it is possible to do so, heads should be removed and the water side cleaned of all debris, mud, and sediment caused by "dirt" that has been washed out of the air by circulating water.

5) If possible, fan and louver openings should be covered or screened to minimize the amount of airborne dirt carried into the cooling tower or evaporative condenser during the winter. This may save considerable cleaning time in the spring before startup.

6) All metal parts exposed to weathering during winter and those exposed to wetting and drying during summer operation should be coated with a good, alkaliproof paint formulated for metal surfaces. Particular care should be taken to follow the paint manufacturers' instructions for preparing the surfaces before painting. This painting does not include, of course, spray nozzles and those parts of the system used for heat transfer. ≠

# PVC Piping Proves Maintenance-Free



**PVC PIPING** to pickling vats was installed using improvised method. Hooks, spaced at 3 ft intervals, permit some sagging in line caused by higher temperatures of pickling liquor. But flow rate is not reduced, so original installation has not been altered

BY L. J. TURNEY
Director of Research
H. W. Madison Co.

**. . . as told to Heating, Piping & Air Conditioning**

POLYVINYL CHLORIDE piping was first installed four years ago in the H. W. Madison Co. pickle and vinegar processing plant in Medina, Ohio, to minimize a difficult corrosion problem. This move was a rewarding one, because this same piping is still in service today.

Prior to its use it had been necessary to replace the metallic piping quite frequently (after three months, in one application) because of the highly corrosive nature of the liquor conveyed to the pickle briner and packing operations. The liquor contains vinegar and salt and sometimes sugar, and this combination of acetic acid and sodium chloride solutions presented a critical corrosion problem. With PVC this corrosion is resisted and replacement has not been necessary.

Plastic piping has also paid off in other plant operations. One of these involves the use of 2 in. and 4 in. lines in the vinegar processing operation. Huge generators filled with beechwood shavings convert alcohol and bacteria nutrients into white distilled vinegar under carefully controlled conditions. After the vinegar has been generated, it is passed through 2 in. PVC piping into a filter and then underground to another building for the pickling process.

The problem satisfied by the plastic piping in this plant is that of keeping the vinegar clean and pure. PVC has proved to leave no contamination nor toxic materials in the vinegar. Also, no discoloration has been experienced.

## Why Was PVC Selected?

PVC piping was selected to handle the pickle liquor and vinegar in this plant because it does not contaminate sensitive solutions, resists corrosion, does not permit buildup of internal deposits in piping, permits high flow rates, has minimum condensation on its surface in high humidity environments, cleans easily, may be installed easily, and has a low initial cost.

In selecting the PVC pipe it was decided that its high rigidity and tensile strength and low rate of thermal expansion would make this material particularly applicable to the requirements imposed by the applications; i.e., the temperatures, pressures, and resistance to the materials being piped.

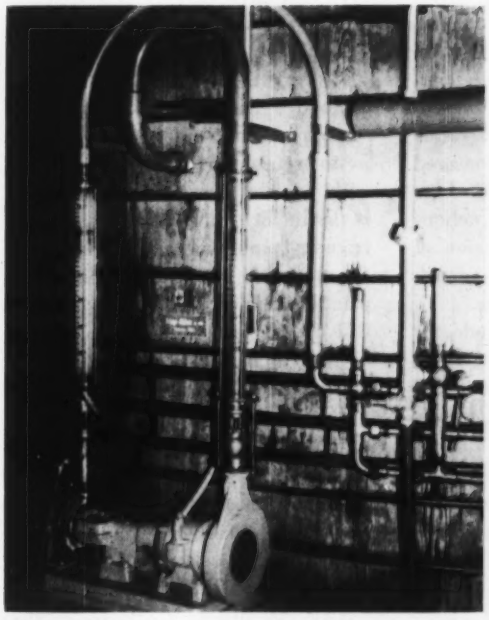
## Support Pipe at 3 Ft Intervals

The 2 in. line for conveying the liquor to the pickling table was installed by an improvised method

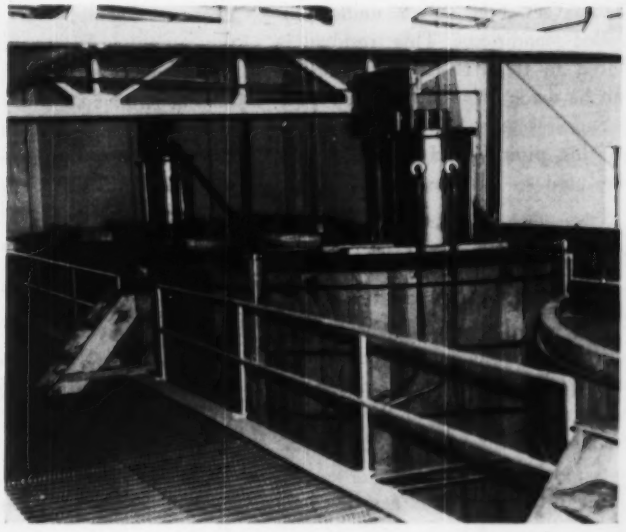
# In Pickle Plant Operation

*. . . after four years' uninterrupted service*

AIR SIPHON MIXER, consisting of 2 in. PVC piping, keeps liquor solution circulating with higher flow rate, thereby preventing sugar from settling to bottom of tank. Compressed air is introduced to bottom of vat through ⅜ in. diam PVC pipe



PVC PIPING serves vinegar processing facilities. No contamination nor discoloration of product has been experienced with these piping systems. Pipe sizes range from 2 to 4 in.



VINEGAR GENERATORS filled with beechwood shavings convert alcohol and bacteria nutrients into white distilled vinegar. PVC piping keeps vinegar clean, pure. System is easily cleaned

using hooks for supporting the pipe at about 3 ft intervals.

Since the temperature of the various liquor solutions is sometimes varied between 135 and 180 F during several hours of operation, some sagging in the pipe exists which could be corrected by increasing the frequency of supports. However, with this slight sagging, no reduction in flow rate has been experienced and no maintenance has been necessary during the four years that the line has been in continuous service. Normally, PVC is not recommended for service temperatures over 150 F.

Stainless steel valves are used on this line. Due to the high corrosiveness of the solution, these must be replaced relatively frequently. Plastic valves have not been used because their temperature limitations may cause them to bind or warp.

In one area of the plant a continuous angle iron is installed to provide a trough-like support. This method, of course, prevents any sagging whatsoever from occurring.

### Serve Critical Waste Disposal

Another instance where PVC piping has been found to save on piping replacement costs is the use of 4 in. lines to and from two huge waste tanks containing extremely corrosive residue from the pickling operations. Because of the high B.O.D. content in the waste products they must be discharged into the Medina sewerage system under controlled conditions. This residue is stored in these tanks until disposal can be made through the lines.

Stainless steel valves are installed on this piping, and special pumps are used to fill the tanks.

### Keep Solution Circulating

Further application of PVC piping is the use of 2 in. sections in connection with an air siphon mixer to keep the liquor solution circulating before being moved to the point of distribution through the 2 in. line to the pickling table.

Air siphon action is developed by introducing compressed air through a $\frac{3}{8}$ in. PVC line to the bottom of the vat containing the liquor. The end of the $\frac{3}{8}$ in. line was compressed, after applying heat, to form a nozzle. Air is directed upward through the bottom of the 2 in. line, thus inducing a flow and causing circulation of the liquid in the vat which prevents the sugar from settling to the bottom of the tank.

### Plan More Uses for PVC Pipe

Existing pipe lines for water and vegetable oils will be replaced with PVC piping as this becomes necessary. It is anticipated that the corrosive atmosphere will shorten the life of this existing piping. The steam lines will not be replaced, however, because of the temperature limitations of PVC.

It is expected that PVC pipe will provide an added advantage in the conveying of vegetable oils, since there is little possibility of contamination of the oil by the piping. Also, a desirable flow condition of the oil is anticipated, especially because the temperature of the oil is maintained at 45 F where the viscosity is relatively high.

Easier cleaning of the piping itself is another advantage that has resulted from the use of PVC. All piping systems and equipment are cleaned thoroughly at the end of each day's operation by flushing with 145 F water. During the four years of operation it has been noted that these systems drain readily and completely.

All pipe joints were threaded and, before joining, were cemented. No leaks have been experienced. ∓

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# Interpret Pressure Piping Code

**Is *refrigerant piping* considered as *process piping*?**

HEATING, PIPING & AIR CONDITIONING periodically publishes for the information of interested parties certain actions of the Sectional Committee B31 on the American Standards Code for Pressure Piping, sponsored by the American Society of Mechanical Engineers. While these actions do not constitute formal revision of the code, they represent the considered opinion of the committee.

Pending revision of the Code for Pressure Piping, ASA B31.1-1955, the committee has recommended that ASME make public certain interpretations.

The following are interim actions and will not constitute a part of the code until formal action has been taken by ASME and by the American Standards Association.

### Case No. 29

*Inquiry*: Is refrigeration piping associated with process operation within the limits of a plant as defined in Par. 302 of ASA B31.1-1955, Section 3, within the scope of Section 3 or of Section 5 of the ASA B31.1-1955, Code for Pressure Piping?

*Reply*: It is the opinion of the committee that a conflict exists in the scope paragraphs of Sections 3 and 5 on refrigerant piping associated with process operation. However, it is the intent of the code that this refrigerant piping associated with process operation within the limits of a plant as defined in Par. 302 of ASA B31.1-1955 is within the scope of Section 3, *Refinery and Oil Transportation Piping Systems*.

For allowable stresses and other requirements and limitations for subzero services see Case No. 30 which was presented in the April issue.

### Case No. 30, Errata

Case No. 30, as it appears in the April issue, contains two errors as follows:

Table 2, column 1, Material—"Monel, 66 Ni—29 Cr, Al" should read "Monel, 66 Ni—29 Cu, Al."

Table 3, column 1, Material—"Monel, 66 Ni—29 Cr, Al" should read "Monel, 66 Ni—29 Cu, Al." ∓

# INDUSTRIAL VENTILATION:

# How Is Its Equipment Selected?

**Industrial ventilation is a necessity. The engineer is not serving the best interests of his client if he does not give careful consideration to the selection of the type of system and equipment for these applications. Low first cost is not a good criterion if the savings thereby gained are overshadowed by high operating and maintenance costs and by poor system operation. With the ever growing complications of industrial processes and manufacturing it is imperative as never before that mechanical systems be well designed and that their component equipment be judiciously chosen to satisfy the requirements of these exacting production needs.**

BY JOHN H. CLARKE
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IN PREVIOUS articles it has been emphasized many times that industrial supply air systems are necessities, not luxuries. This is so because without supply air the requirements for essential fume and heat removal, temperature control, and process air cannot be met.

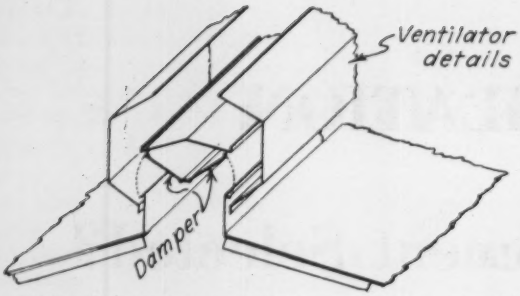
If we agree that this premise is correct, then it follows that the equipment chosen to provide the supply air for our industrial systems should be selected with great care. This will usually require thorough engineering, specifications, and design. No equipment should be selected simply because it permits short cuts to meeting any one of these three requirements.

Cost is always a factor. But as many eminent authorities have mentioned, we get what we pay for in this world and cheap equipment is usually cheap equipment. Something has to be left out or it couldn't be sold for less. What has been left out may not affect the requirements of the equipment in some cases, and the savings are worthwhile. In other cases the savings do affect performance requirements, and such savings are false economy.

In selecting industrial equipment, the above comments should be carefully considered. In this article it is intended to review the applications, advantages, and shortcomings of package or over-the-counter equipment.

### Choose Ventilators for Low Air Flow Friction

The best outlet for natural exhaust is a well designed, low friction hole in the roof. Ventilators should be se-




**1** CONTINUOUS ROOF VENTILATORS are most desirable for natural ventilation where large air volumes must be moved

lected with this in mind. Weather tightness should be provided as required for the job. For large capacities the continuous roof ventilator shown in Fig. 1 would be the first choice. If dampers of the type indicated are provided, the flow friction will be considerably reduced. A similar cross-section is desired for round type of ventilators.

Units of the fixed or rotating type which are primarily designed for wind induced flow are less desirable because the baffling which creates induced flow also reduces flow when there is no wind. Where used, such ventilators should be sized for convection flow, without wind.

Some ventilators, Fig. 2, are designed with vanes which are intended to turn them away from the wind in order to induce air flow. Such ventilators have been known to stick turned into the wind. Consequently, they are not recommended for natural ventilation service where reversal of flow would create fume, heat (in the work zone), or weather problems.

In those cases where mechanical supply air is provided and the air must escape naturally, relief openings are necessary. These can be any of the mentioned recommended natural ventilators. In some cases relief vents (multiple louvers), Fig. 3, have been provided in the walls. Because of wind pressure problems, roof openings are definitely preferable. But where wall reliefs must be used these should always be manually or motor (pneumatic or electric) operated. Undesirably high building pressure is required to open such louvers "naturally" and, in addition, such louvers have a habit of sticking.

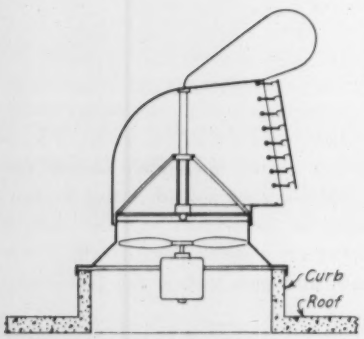
### Wall Fans Subject to Variations in Air Capacity

Wall fans may be of many types having pressure, semi-pressure (to 1.0 in. water gage) or low pressure (to 0.50 in. WG) characteristics. The pressure and semi-pressure fans may be used with ductwork and to varying degrees with filters, air heaters, and cooling coils. In effect, such installations fit into the category of air handling units, which are described later.

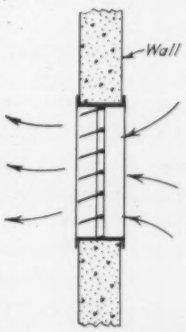
Most wall fans are of the direct drive disc or propeller type having low pressure characteristics. These are installed in walls, monitors, or penthouses, Fig. 4, with either gravity or power operated louvers and with or without hoods.

Because variations in wind pressure represent a considerable percentage of the fan pressure capacity, such fans are subject to wide variations in air capacity during operation. To minimize this, hoods, as shown in Fig. 4, should be provided for both supply and exhaust fans. These fans should not be sized on the basis of free delivery. Capacities should be based on at least 0.10 in. WG, and this must be increased if the building is under negative pressure.

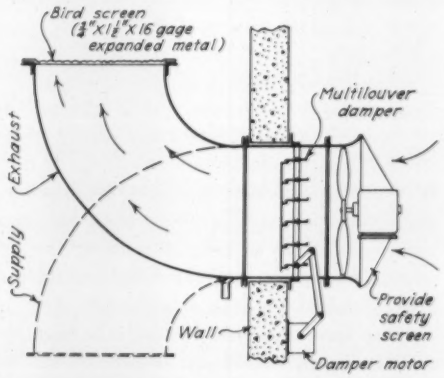
It is always important to check the pressure characteristics of wall fans. The best selection will have a relatively small change in capacity with a change in static




**2** ROTATING TYPE ROOF VENTILATORS may be provided with or without fans. Not recommended for natural ventilation (without fan) because they may stick when turned into the wind. This would cause reversal of flow which would create fume, heat (in work zone), or weather problems




**3** WALL RELIEF OPENINGS (multi-louver dampers) are frequently provided for systems having mechanical supply and natural exhaust. Roof openings through natural ventilators are preferable. Where these are used, dampers should be motorized. Gravity type tend to stick frequently and require excessive building pressure to move them




**4** PROPELLER TYPE WALL FANS should always be installed with hoods to minimize the wind problem. Motorized dampers must be used in most cases for supply fans and are always preferable because gravity dampers frequently stick and create excessive friction for these low pressure fans. Roof fans are preferable to wall fans

pressure, at the design condition. However, fans with steeper pressure curves usually have overloading characteristics at shutoff. Their motors should be sized with this in mind.

Motor operated louvers are definitely perferred because of the pressure required to open the blades (particularly against a wind) and the friction of the blades in the partially opened operating position of gravity operated louvers.

The use of these fans should be restricted to areas requiring nominal supplementary ventilation for additional heat relief, mainly in the summer. They should be installed in accessible locations for easy inspection and maintenance so that they will be well serviced. If this is not possible, it may be better to consider using roof fans.

### Roof Fans' Gravity Louvers Give Good Service

The characteristics and pressure requirements for roof fans, Fig. 5, are similar in most cases to those of wall fans, and the same comments as to pressure characteristics would apply.

Exhaust gravity louvers give good service with a minimum of friction, although, like all gravity dampers, they must be serviced and checked frequently to prevent sticking. Motor operated dampers must always be provided for the supply units, of course.

The weather hoods for these units minimize the effect of wind. The butterfly damper type of weather cover, Fig. 5c, is desirable over hot equipment because it will minimize roof deterioration and will discharge the hot air upward to help in dissipating the heat. However, the higher pressures (and fan speeds) required to open the dampers tend to make them noisy.

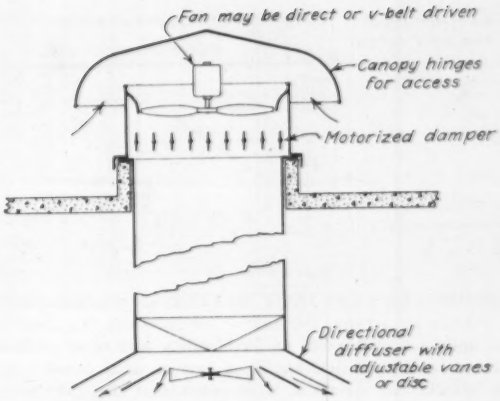
For general fume removal a stack similar to the alternate discharge of Fig. 5c may be used to discharge the effluent even higher, to aid in dispersion, and to reduce building re-entry. This will also permit the selection of a quieter fan. The time honored, inverted cone stack cap — which has defied a century of progress — can be dispensed with.

The housings on these units may sweat in the winter in areas where a moisture load exists. This may require drip pans under the units or housing insulation or both.

These fans may be purchased for either direct or v-belt drive. The latter is desirable because it provides versatility in application, building balance, and capacity. In all cases an arrangement should be provided which will permit good access to the motor and dampers.

On flat roofs the maintenance of these units should be relatively easy if convenient access is provided to the roof. Otherwise, the operation will suffer because of poor maintenance. The supply canopies can, in some cases, be provided with filters. But if dirt is a problem it is recommended that a more suitable supply unit be installed.

These fans are best suited for supplementary summer supply and exhaust for which they will give excellent service if properly installed, as noted above. They should


Fan may be direct or v-belt driven
Canopy hinges for access
Motorized damper
Directional diffuser with adjustable vanes or disc
Fig. 5a

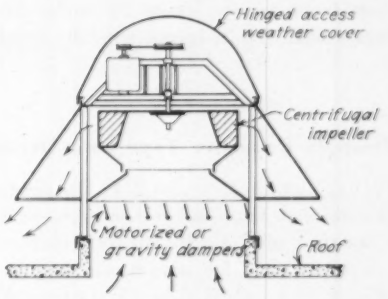


Fig. 5b

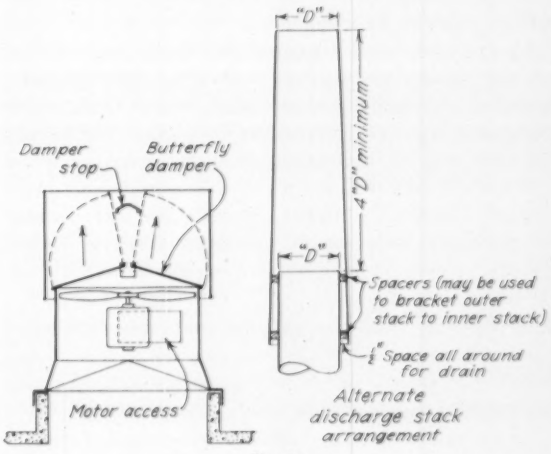
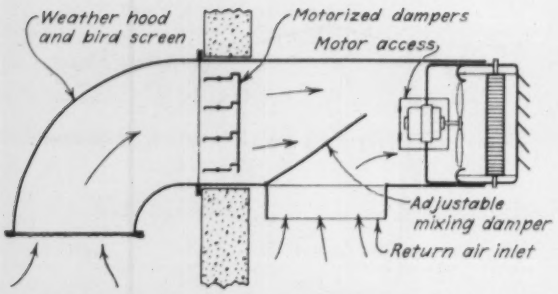


Fig. 5c

**5** ROOF FANS are preferable for general building exhaust and supplementary supply air. Available in either direct or v-belt drive. Grease extensions should be provided where possible to permit easy servicing. Because of remote locations lockout type push buttons or disconnect switches should be provided at fans for safe servicing. Butterfly type of exhaust head (Fig. 5c) should be provided where it is desired to discharge hot air or fumes upward. However, this arrangement tends to make fans noisy because of pressure required to open dampers (higher speed fan). For higher discharge, alternate stack arrangement may be used




**6 PROPELLER TYPE UNIT HEATERS** are not recommended for makeup air service. Because of low pressure fan characteristics units are vulnerable to dirt loading and wind problems which make them unreliable. Locations of units usually make them difficult to maintain, with result that they are seldom serviced properly

not be used for supply systems which are essential and require continuous service, except in warm climates or where process heat can be mixed with the supply air to temper it.

## Don't Misapply Propeller Type Unit Heaters

Propeller type unit heaters also have low pressure characteristics similar to those of the low pressure wall fans. They are designed and intended for recirculation heating. The use of these units for outside air supply, as indicated in Fig. 6, is marginal at best and cannot be recommended for industrial systems. There are units available which will provide acceptable makeup air service. These are designed specifically for this purpose and are described under air handling units.

Unit heaters, while designed for the heater friction, are not capable of operating with filters. On recirculation the steam and hot water units require much maintenance because of internal building dust which considerably reduces their heating and air capacities. When used with outside air, the problem is considerably more critical. Usually the heater elements are not suitable for operation with outside air below freezing. Consequently, automatic temperature control by modulation should not be attempted under such circumstances, because this may result in damage to the heater element.

Propeller type unit heaters are also available with gas firing. Where used, the safety precautions outlined under air handling units should be observed.

These units are not recommended for ventilation service. But if they are used, any ductwork must be short and friction must be kept to a minimum. They should be located as conveniently as possible because their reliability is usually impaired by the difficulty in getting to them for inspection and servicing.

### Variety of Package Units Available

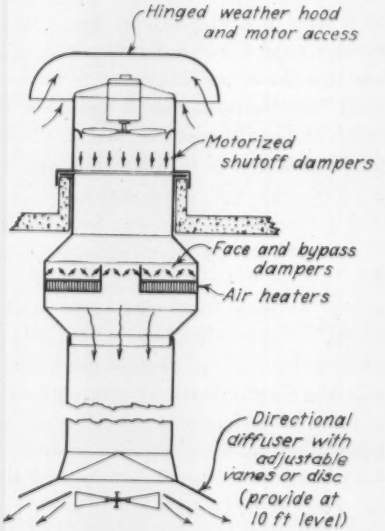
Heating, ventilating, and air conditioning air handling units come under a category which is a catch-all including a large variety of package units designed for air handling, filtering, heating, cooling, humidification, and dehumidification. By fan types they divide into the axial flow (vaneaxial, tubeaxial or propeller) and the centrifugal (multifan or single fan, forward curved or backwardly inclined blading type). They also may be of the pull-through or blow-through type. By heating medium these divide into two general classes: (1) units designed for use with steam, hot and chilled water, refrigerant direct expansion, and chemical or capillary humidity control; and (2) direct fired oil or gas heating units.

Gas and oil fired units are not subject to freezing problems, but care must be taken to provide them with proper, approved safety controls. The products of combustion must also be removed. Direct fired gas and oil units should not be used in areas under negative pressure because the stack gases cannot be safely discharged under these conditions. Open flame gas units should be designed with sufficient supply air to keep the carbon monoxide content below 25 parts per million. The safety controls should not permit operation of these units unless the fans are running.

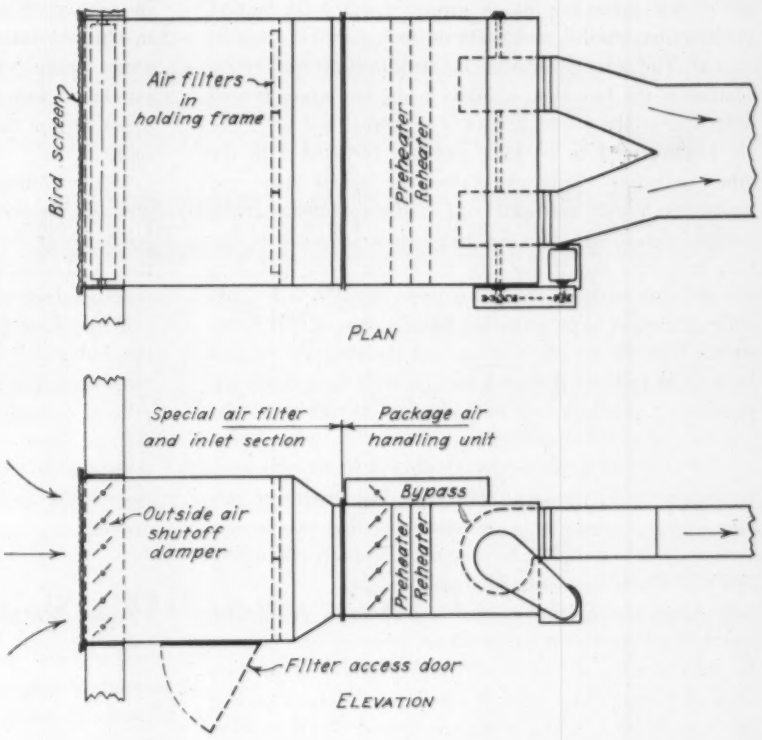
Neither direct nor open flame heaters can be used in areas where flammable materials may reach the combustion chambers. In all cases, state and local code requirements should be checked before considering oil or gas operation.

Typical types of these air handling units are indicated in Figs. 7 and 8.

These units have good pressure characteristics for duct




**7 PROPELLER TYPE AIR HANDLING UNITS** (axial flow) for makeup air may be provided with direct or v-belt drive and may be of blow-through (as shown) or draw-through type. Blow-through type is preferred here because of easier servicing. Draw-through arrangement provides better mixing (less stratification) and consequently permits better temperature control. Unit may be arranged for vertical flow with unit set on roof or may be installed horizontally (ceiling hung) with either roof or wall intake. Provide grease extensions and safety disconnect switches as indicated for Fig. 5




**8** FILTER ARRANGEMENTS usually provided for conventional type multifan centrifugal air handling units are usually poor. Built-up section, as shown, is recommended. This will provide better filtering, easier maintenance. Common discharge duct is required in order to permit air mixing which will reduce temperature stratification when steam is used as heating medium. Similar air handling units are available in oil and gas firing

distribution and are available in capacities to about 40,000 cfm for either the axial type or the single- or multifan centrifugal type. Considerable flexibility in application is possible because of the number of types which may be provided. Because they are relatively low in cost and are compact, they have had a great many uses in industry. Many of these have not been good applications, however, based on the fundamental principles that make-up air is essential, and that ease of operation and maintenance, and reliability are important.

### Consider These Factors in Choosing Package Units

The following factors have considerable bearing on the choice of these units:

1) Most of these units are either hung directly from the roof or are mounted overhead. Where this is the case access for inspection and maintenance is costly, and the units are frequently neglected. Reliability and service life suffer accordingly. Therefore it is important to locate the units in penthouses, on accessible platforms, or at floor level.

2) Where filtering is necessary, the filter arrangements, particularly the slide-in type, result in poor efficiency and maintenance. Shaft and casing leaks admit large quantities of dirt to the system. The units should be ordered with conventional unit type filter holding frames which have tight seals. Usually it is worthwhile to provide a special built-up filter section, as in Fig. 8, in order to permit this and to assure a good filter installation. A filter access door of adequate size should be provided. The casing should be made dust-tight and shaft seals should be provided at the casing.

3) Because of their compact design it is very difficult to get at the heaters, cooling coils, and fans for inspection, cleaning, and other maintenance. In many cases it is necessary to remove the panels to get at the equipment. This discourages servicing. Fans, air heaters, and cooling coils require considerable cleaning in order to maintain the design capacity if the supply air is not properly filtered. Easy access is mandatory for this maintenance. Similarly, access doors to each compartment should always be specified.

4) The multifan centrifugal unit is vulnerable to vibration and excessive bearing wear because of the longer shaft span required with external bearings. To minimize this, the fan speed should be kept below the first critical speed. Internal center bearings are not desirable in such cases because of the problems of alignment and access for maintenance. For these reasons, some manufacturers now supply single fan units up to their largest sizes. In general, the shape of the space available determines the number of fans used. Where they can be used, single or double fan units are less expensive to buy, install, and maintain.

5) With the steam heated centrifugal units in particular, it is difficult to avoid temperature stratification and control and freezing problems. Efficient fans, regardless of number or type, will permit stratification to pass through them because they are not designed as mixing devices. The problem of stratification should never be underestimated. It can be minimized through the

use of hot water heating of proper design with respect to circuiting, control, and safety devices.

a) The principal reason for stratification with steam heating is the fact that, at light loads, the steam is condensed near the steam header. For centrifugal units the air heaters tend to be long and are installed with the tubes horizontal. This accentuates the stratification and makes the heaters susceptible to freezing. Combining the outlets into a single duct will help to reduce the stratification problem; but if the first branch is near and in a straight line with the unit discharge, trouble will probably still occur. For units handling return air, it is essential that the return location and the damper rotation be such as to force thorough mixing with the outside air. Return air should never be brought into the unit over and parallel to the outside air.

b) The air heaters should always be of the antifreeze (inner distributing tube) type. For lengths greater than 6½ ft (tubes) it is recommended that two heaters (end to end, in parallel) be specified. Properly controlled, this will minimize stratification and freezing.

6) Good temperature control is difficult to obtain with steam. Poor control may result in freezing the heaters. In mild weather it may result in overheating. Low limit or duct (tempering) control can be maintained only if the stratification problem can be solved. With makeup units which do not have distributing ductwork the control problem becomes more difficult because it is not possible to locate the thermostats for proper low limit and tempering control.

a) The best all-around control for these units is face and bypass control used in conjunction with modulating steam control valves. The latter are essential to prevent overheating in mild weather. Where two air heaters are provided end to end (instead of one long heater) a steam control valve and duct or low limit thermostat should be provided for each heater. The thermostats should be located, of course, on the duct discharge (or side) downstream from the heater it is controlling.

b) Where a discharge header is perpendicular to the unit discharge, and where it is led to one side only, sufficient mixing will occur in the single duct to permit temperature control by means of modulating steam valves only.

c) As added control precautions, the outside air dampers should close on fan shutdown and the unit should be stopped when necessary by low limit condensate or air thermostats. A system controlled by a room thermostat must always be protected by a low limit thermostat. Additional control information will be outlined in a later article. For further information see the article *Why Steam Coils Freeze and How to Combat This Problem*, by H. W. Alyea, in the April and May issues of Heating, Piping & Air Conditioning.

7) For cooling applications the insulation on these units is generally installed on the inside, including the insulation for the bottom pan, in order to prevent damage during shipment and erection. On some units, particularly where bought on price, the insulation has been marginal in quality. Sometimes it has become soaked, resulting in plugged drains, odor and mold problems, and maintenance headaches. It is recommended that these units be purchased without the pan insulation, and that the owner apply this on the outside at the time of installation of the unit.

If the aforementioned comments are carefully considered, if proper maintenance is provided, and if these units are applied to jobs for which they are well suited, they will give reasonably good, inexpensive supply and makeup air service.

While these factory built units have a definite place in the industrial ventilation picture it should be kept in mind that, for systems which are essential to plant and process operation, there is no substitute for the built-up system. These can be designed for high quality and performance for the specific job to be done. The design of these built-up systems will be discussed in a future article.

## Protect Motors, Other Equipment from Dust

With very few exceptions, the motors for industrial ventilation fans and air handling equipment should be totally enclosed. All starters, controls, thermostats, relays, and allied electrical equipment should be dustproof. Components that are not dustproof should be located in a dust-tight enclosure. While these requirements cost more initially, they save considerably in maintenance and add greatly to the reliability of the equipment. There are very, very few places in industrial areas that are dustfree.

In areas where explosive vapors or dusts may be present, explosionproof equipment is required. In some cases this will require direct drives in lieu of v-belt drives. Where the latter are permitted, they should be of the nonsparking type. In all cases the motors and the fans should be grounded.

For remote fans, lockout type stop buttons or disconnect switches should be provided at the fans to permit safe servicing.

The motors for this equipment should be sized to allow a margin for low voltage, v-belt drive friction, speed adjustment to permit operation at design volume, and to allow for nominal error in the system friction and actual fan capacity. The present day practice of loading motors up to full or even to overload rating is poor practice in any case. This should never be done for these essential applications. ∓

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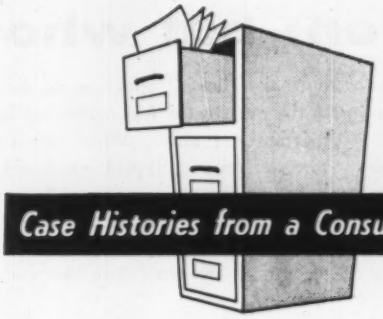


## Case Histories from a Consulting Engineer's Files

BY C. T. BAKER
Consulting Engineer

**Modern air conditioning systems, for efficient and satisfactory operation, must be correctly designed. Here are five typical cases from the author's experience where original design was faulty and had to be corrected.**

# • misplaced air intake costly

THE MANAGER of a large retail store complained that the interior walls of his building were being injured by the air conditioning system and also that his merchandise was being damaged. I was asked to look the plant over and determine, if possible, what was causing the trouble.

I found an orthodox installation, one that had been well designed and properly installed. The equipment had performed satisfactorily previous to the summer of 1937. Then things began to happen to walls and merchandise. The management had decided upon a change in location of the outside air intake duct which brought outside air to the plenum chamber on the second floor.

When the changes were completed, the air duct terminated over an unpaved alley from which every passing truck or car filled the air with dirt and dust. In addition to this source of contamination, it was the practice of a restaurant owner next door to burn trash in the alley, usually three times a week. A small groceryman, likewise, disposed of his trash and refuse in the same manner as his restaurant neighbor.

It does not take much imagination to see what this back alley practice was doing to the store.

The owners had to pay well to find out what they must do to be saved.

# • system stingy with outdoor air

ON THE GROUND FLOOR of a multistory office building, there is a very attractive cafeteria patronized by the office personnel and the general public in the vicinity. The equipment is the very latest and service is efficient and up-to-date. About 200 persons can be served at one sitting. During the noon and evening peaks, all tables are filled, and customers are lined up awaiting their turns at the serving counters. Counting employees, a total of about 250 persons occupy the enclosed space. To this number, which alone creates a problem in maintaining comfortable temperatures, must be added the many pounds of hot foods and drinks, the coffee urns, the steam tables, and all other equipment common to a modern cafeteria.

The sign on the door says, "It's air conditioned inside," but the patron coming from the outside where air, though hot, is fairly fresh, is instantly repelled by the foul, stale air of this otherwise impressive food serving establishment.

Although the senses gradually become adjusted to the condition, the patron continues to muse over the question of why a machine designed to supply comfort if given half a chance should be doing such an inadequate job. It is only reasonable to expect from a cooling system, air that has been cooled, dehumidified, and filtered, with sufficient outside air included to insure proper ventilation at all times, regardless of internal conditions and the number of persons being served. To be sure, a small amount of outside air is introduced, but nowhere near enough to insure the number of air changes required for adequate ventilation.

At times, the humidity in this restaurant is quite high, indicating that insufficient latent cooling is taking place. Apparently then, the dry bulb temperature is reduced several degrees without moisture removal, which means, of course, that the humidity goes up. The owners should be alarmed to know that their patrons are beginning to comment and to compare the air conditioning in this establishment with those in other places where systems have been properly designed and are being properly operated.

## • find solution; but who pays?

A CERTAIN air conditioning plant was reported as unsatisfactory. Investigation disclosed that the trouble occurred when the compressor was started in response to the thermostat.

This was a small plant which provided cooling for one fairly large room where five or six persons were employed.

When the compressor was stopped by thermostatic control and later started, a terrific pounding occurred. This would last for several minutes until the machine settled down to normal. The introduction of liquid to the evaporator was controlled by a thermostatic valve. When the compressor stopped, liquid continued to flow into the evaporating coil, and if the compressor was off the line long enough the coil would fill solid and sometimes overflow into the suction line.

Obviously, when the compressor started, it had to handle raw liquid for a considerable period of time. This was causing the heavy pounding of the machine.

When told that this condition could be entirely corrected by the installation of a solenoid valve on the liquid line to open and close with the starting and stopping of the compressor, the owner claimed that the contractor should make this installation gratis. The contractor claimed that his contract did not call for such a valve.

They are still arguing the case. In the meantime, the compressor is taking an awful licking and is not long for this world.

## • oil collecting pot aids operation

Two 4 × 4 in. compressors, each mounted on a common cast iron base with a shell and tube condenser immediately beneath, comprised an ammonia refrigerating plant. An oil drain had been provided in the bottom of the shell of the condenser, but it was not very effective, as seldom could more than a very small amount of oil be removed through it. As a result, a great deal of trouble was experienced with oil accumulations in the unit coolers installed in the various rooms of the building. Since no liquid receivers had been provided, the condenser acted both as a condenser and a receiver.

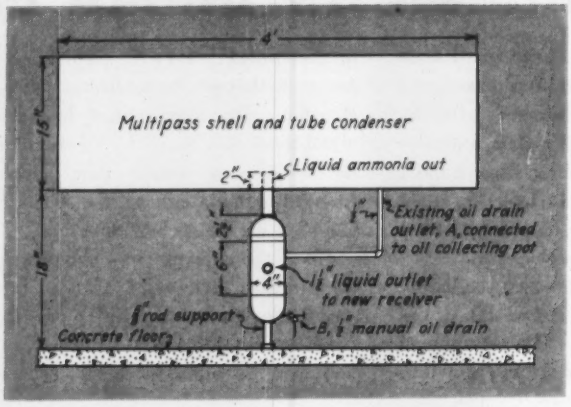



Fig. 1.

To improve conditions, an oil collecting pot, *A*, was installed as shown in Fig. 1. Its function was to collect oil from the condenser, from where it could be later removed through the oil drain valve, *B*. Unfortunately, the limited space between the bottom of the condenser shell and the floor would not permit the use of a larger oil pot. However, the installation gave very satisfactory results and completely eliminated the necessity for frequent drawing off of oil accumulations from the unit coolers. In addition, the absence of oil accumulations in the cooling units materially improved their operation by permitting greater heat transfer between the evaporating refrigerant and the air passing over the coils.

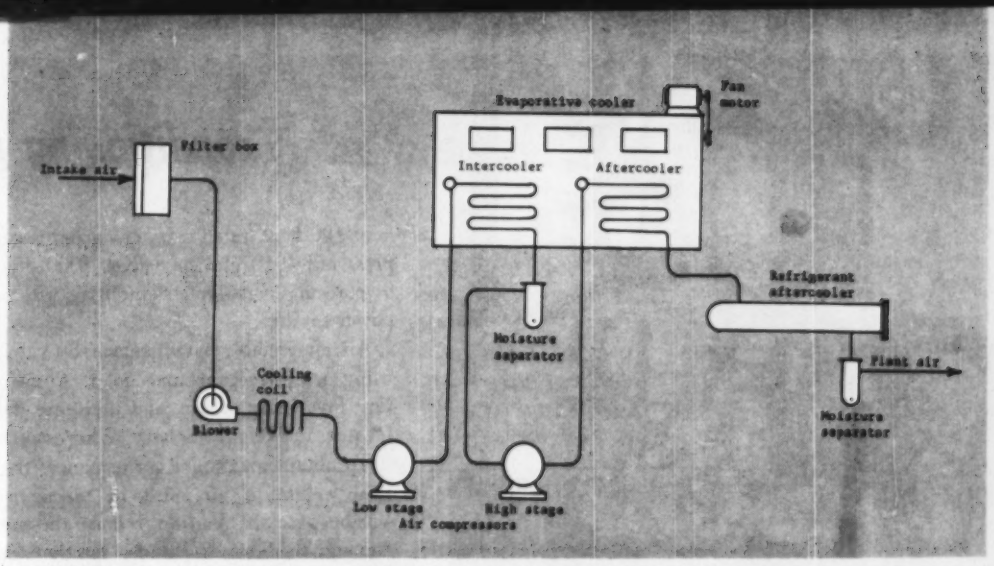
Incidentally, cleaning the condenser tubes, removing air accumulations from the system, and the installation of an ammonia receiver — which permitted all of the tube surfaces in the condensers to be effective — resulted in a substantial reduction in condensing pressure and a sizeable reduction in power costs.

In self-contained units of the design used in this installation, there is not sufficient room between the compressor and the condenser to permit installation of a high pressure oil trap.

## • exhaust lines relieve tower

A COOLING TOWER on the roof above the compressor room cools the condensing water for a 15 ton air conditioning plant. Two exhaust steam pipes extend through this roof, one on either side of the tower. Consequently, most of the steam which passes through these exhaust lines is pulled into the tower by the prevailing air currents.

In effect, the tower acted largely as a steam condenser, working against great odds to cool sufficient water to keep the condensers supplied, but not enough to hold condensing pressures at a minimum. Exhaust lines are being properly disposed to correct the trouble. ∓




CONDITIONED COMPRESSED AIR SYSTEM filters intake air and dehumidifies it by cooling before air is compressed. Further moisture is removed between two stages of compression. Oil as well as moisture is separated from air at refrigerant aftercooler before air is delivered to plant

# Here Are Fundamentals Of Conditioning Compressed Air

## *. . . for industrial piping services*

**The use of compressed air is rapidly increasing in all phases of industry. By processing "raw" air, it is possible to materially improve plant compressed air system performance and cut operating and maintenance costs. Moisture, especially, in compressed air results in a high attrition of modern pneumatic tools, valves, and other components in the piping system. Here's how to design and install conditioning equipment to provide a continuous source of clean, dry air, always available, and adjustable to fluctuating air quantities and varying entering air temperatures.**

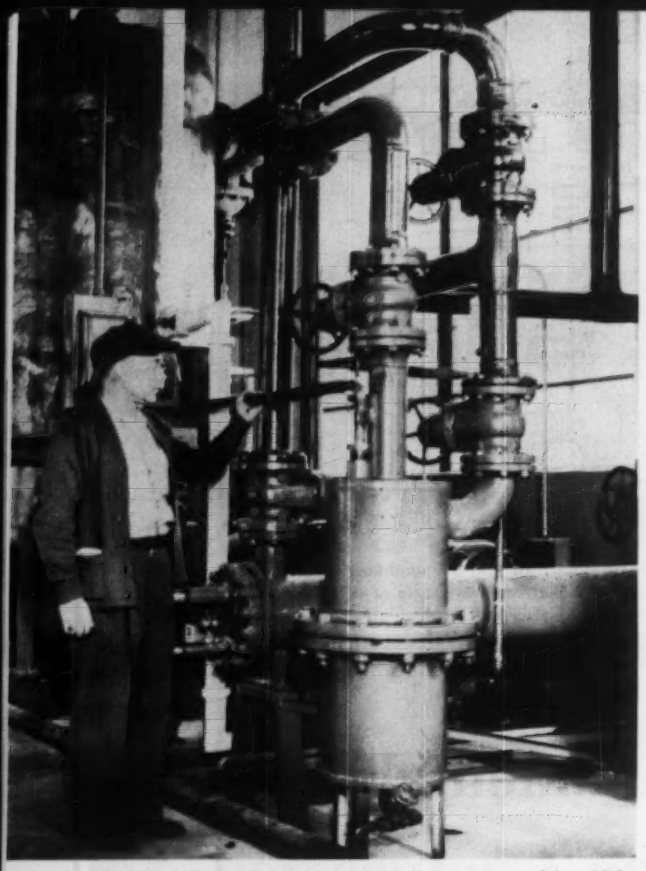
BY FRANK D. ROSS
Mechanical Engineer
Advanced Engineering & Supply Corp.

COMPRESSED AIR is vital to the operation of many modern tools and methods today. If it is conditioned from the point of intake to the point of final use, operation and maintenance costs can be appreciably cut. In some cases, for example, conditioning may make unnecessary the replacement of a compressor with one of larger capacity.

Conditioning starts at the air intake, which should be at the coolest and cleanest location available. It should be as close as practical to the suction intake port of the air compressor.

Air, while seemingly clean, contains contaminants that may abrasively wear valves and moving parts. Thus, efficient air filters are mandatory. Filters may be dry, washer, or electrostatic. An electrostatic type with cleanable filters makes an efficient combination.

Reciprocating air compressors are invariably used for



DRYING CHILLER — horizontal unit, center — dehumidifies air by lowering its temperature to 60 F under pressure. Air is then heated to 310 F in large dryer, left

the plant air system. They are generally multistage units. The air is brought up to a certain pressure in one cylinder and the temperature reduced in an intercooler. From there it enters a second cylinder, where the compression is carried to the desired terminal pressure. The cylinder ratio is such that the work is normally equally divided between the cylinders, but changes in conditions of operation may destroy this equality.

Compressors are rated at their actual intake displacement under a definite set of conditions. Of prime importance is the condition of the air at the intake port. Compressor manufacturers use the term "standard cubic feet per minute" displacement. Standard air is defined in the American Society of Mechanical Engineers air compressor code as air at 68 F and 14.7 psig having a density of 0.075 lb per cu ft, with a relative humidity of 36 percent.

Throughout the U.S., climatic conditions are often higher than standard conditions. The change in volume of "dry" air resulting from a change in temperature is shown in Table 1.

Compressed air in the transmission mains is soon at the plant's ambient temperature. If the temperature of the air introduced into the cylinder is the same as the plant's ambient, the number of cfm entering will be equal to the cfm of free air at the point of utilization. Suppose the intake air is at 50 F and the plant ambient

## . . . conditioning increases

is at 100 F. A rated scfm compressor would have to compress only 910 cfm to deliver 1000 cfm, or a saving of 9 percent in volume handling, with a corresponding power saving.

An appreciable saving normally can also be obtained using a refrigerant antecooler. Condensation of moisture invariably occurs, and there are definite advantages for the intake air to have a low moisture content.

To obtain maximum performances the maximum practical weight of air must be taken in at each stroke. Various factors tend to reduce the intake air density. Among these are altitude, friction drop through air filters, suction intake piping drop, barometric pressure, and the inlet valve and valve passage resistance.

Because of the diminished density of the atmosphere above sea level, there is a greater difference between terminal pressure and atmospheric pressure. The compression ratio is greater, and it is necessary to pump more cfm per unit weight. Lower density of the air decreases the power input to compress air, but it does not vary in the same ratio as the decrease in capacity.

The volume of air under conditions other than 29.92 in. Hg may be obtained from the following equation:

$$V = (29.92 - p_a/P - p_a) \quad \ldots\ldots\ldots [1]$$

*where*:

$V$ = volume of 1 lb of air at given pressure, cu ft per lb
$V_a$ = volume of air at 29.92 in. Hg
$P$ = barometric pressure, in. Hg
$p_a$ = absolute pressure of water vapor, in. Hg, at dewpoint temperature.

The reduction of pressure for altitude is about 1 in. Hg for each 900 ft elevation above sea level. Using a blower and antecooler, the intake air can be delivered to the compressor port at the density and at the temperature suitable for maximum compressor performance. As a further refinement, the intake pressure may be accurately controlled with a pneumatic static pressure regulator.

Suppose a compressor delivers 1000 cfm of free air at 26 in. Hg, with intake air conditions of 95 F dry bulb at 70 F dewpoint. Under these conditions the air density would be 16.46 cu ft per lb. Pressurizing to 29.92 in. Hg with intake air at 55 F DB and 46 F dewpoint, the density would be 13.11 cu ft per lb. To deliver 1000 cfm of free air, only about 800 cfm need be compressed — a 20 percent volumetric saving.

### Use Stage Compression for Over 70 Psig

Air introduced into the cylinder is subject to compression. For pressures over 70 psig, compound or stage compression is generally used. For small capacities and intermittent service, the usual practice is the use of a single stage unit. The principal advantages are:

1) Lower final discharge temperatures

2) Reduced horsepower requirements
3) Interstage cooling and moisture removal
4) Improved lubrication
5) Reduction of strains on working parts
6) Improved volumetric efficiency

In reciprocating compressors, air is compressed somewhat below the adiabatic curve. Some cooling occurs in the water jackets but will not affect to any appreciable degree calculations of the total heat rejection. When air is compressed, it is heated. Before introduction into the high pressure cylinder this air must be cooled. The compression ratio and the initial air temperature determines the adiabatic discharge temperature.

It is customary in compressor design to limit the compression ratio between 2.5 to 4.0 compressions per stage. In a two stage compressor the ratio of compression per stage is approximately equal to the square of the total ratio of compression.

To obtain the heat of rejection to the interstage cooler, three sources of heat must be considered:

1) Actual air temperature reduction
2) Condensation of moisture
3) Mechanical friction heat.

The discharge temperature may be calculated from the basic adiabatic air compression equation:

$$T_2 = T_1[(P_2/P_1)0.283] \quad \text{.....[2]}$$

*where*:

$T_2$ = final absolute temperature, F
$T_1$ = inlet absolute temperature, F
$P_2$ = outlet absolute pressure, psig
$P_1$ = inlet absolute pressure, psig.

To simplify and avoid use of awkward exponents, convenient multipliers are available. These permit conversion of the intake port temperature to adiabatic discharge temperature. Some of these multipliers, $M$, are listed below:

Adiabatic Temperature Multipliers

| $P_2/P_1$ | $M$ | $P_2/P_1$ | $M$ |
|---|---|---|---|
| 2.20 | 1.26 | 3.04 | 1.38 |
| 2.36 | 1.28 | 3.20 | 1.40 |
| 2.60 | 1.32 | 3.38 | 1.42 |
| 2.80 | 1.35 | 3.60 | 1.45 |

For example: Determine the final air temperature of air entering at 100 F and subject to 3.6 compressions.

**TABLE 1—PROPERTIES OF DRY AIR listed here show changes in volume resulting from changes in temperature**

| Temperature, F | Volume, cu ft per lb | Density, lb per cu ft |
|---|---|---|
| 40 | 12.597 | 0.07937 |
| 50 | 12.849 | 0.07782 |
| 60 | 13.101 | 0.07633 |
| 70 | 13.353 | 0.07491 |
| 80 | 13.605 | 0.07348 |
| 90 | 13.858 | 0.07215 |
| 100 | 14.110 | 0.07087 |
| 110 | 14.362 | 0.06963 |

(100 F + 460 F)1.45 = 812 deg abs, or 352 F .....[3]

To avoid high discharge temperatures, the importance of low initial temperature is evident. If, in the above example, the initial air was 55 F, the final air temperature would have been 286 F. The intercooler should be selected to achieve the lowest practical reduction in air temperature. The heat rejection due to the temperature may be calculated:

$$\text{Btu per min} = WC_p(t_1 - t_2) \quad \text{.....[4]}$$

*where*:

$W$ = actual lb of air per min
$C_p$ = specific heat of air, Btu per lb per F
$t_1 - t_2$ = air temperature drop, F.

## How Much Moisture Can Be Condensed?

Water in a vaporized condition is always present in air. The amount of water which can be held before condensation occurs is in direct proportion to the temperature and in inverse proportion to the pressure. Or in other words, the greater the pressure, the less vapor it can hold. The amount of water vapor actually condensed is simply the difference between the amount taken into the compressor and the amount of moisture present in the air leaving the intercooler. The amount of moisture involved may be computed as in Equation 4. The heat rejection is:

$$\text{Btu per min} = W(h_1 - h_2) \quad \text{.....[5]}$$

*where*:

$W$ = lb of water vapor condensed per min
$h_1$ = enthalpy of vapor at final partial pressure and temperature, Btu per lb
$h_2$ = heat of water leaving intercooler, Btu per lb.

The values of $h_1$ and $h_2$ may be found in steam tables. Multiplying the initial partial pressure of the intake air by the ratio of compression will show the partial pressure existing at the final pressure. Unless the heat rejection load must be calculated with precision, for the average compressed air system, the latent heat of condensation may be safely assumed at 1200 Btu per lb of water.

Heat rejection resulting from mechanical friction is a variable factor and when possible should be verified from the compressor manufacturer. For the usual low and medium pressure systems it may be conservatively estimated by allowing an additional 5 to 7 percent to the total heat of rejection load. Radiation losses have not been considered, but these are dividends favorable for cooling equipment selection.

## Intercooler Lowers Discharge Air Temperature

Theoretically, the intercooler should lower the low cylinder discharge air temperature to that which prevails at the intake. Unless a sufficient quantity of cool water is available, this ideal temperature could not be

obtained. The intercooler furnished by the compressor manufacturer is designed to bridge the space between low cylinder discharge and high cylinder intake. This shell and tube apparatus normally is rated to cool the air to within 20 F of the entering water temperature.

Conservation of water is practiced or made mandatory in most localities. It is, therefore, essential that cooling tower water be used.

The temperatures and pressures involved for most plant air systems are well within those encountered in refrigeration systems. Within these conditions, the evaporative condenser has wide acceptance and is accepted as good engineering practice.

The cooling efficiency of the well designed evaporative condenser permits air to be cooled to a close approach to the ambient wet bulb temperature. Every 10 F decrease in the temperature of the air delivered to the high pressure cylinder decreases by about 1 percent the total power required for compression. Air may be cooled to the inlet temperature by a refrigerant aftercooler installed between the intercooler outlet and high stage cylinder. With the installation of this heat exchanger it is feasible to cool to the temperature prevailing at the low pressure cylinder intake.

### Evaporative Condenser Is Good Aftercooler

The aftercooler performs the same function as the intercooler. An aftercooler is an essential part of nearly every compressed air plant. In addition to moisture, some lubricating oil is carried from the compressor cylinders. This oil vapor should also be condensed, minimizing the hazard of explosion. The heat rejection to the aftercooler may be calculated in the same way as for the intercooler.

An evaporative condenser makes an efficient aftercooler. A single, split circuit evaporative condenser may be utilized for both inter and aftercooler heat of rejection. A basic requirement would be maximum temperature drop consistent with practical attainment together with a minimum air pressure drop. The evaporative condenser should be designed and circuited for the requirements. Since it is not being used in a closed refrigerant cycle, the free area of the tubing must be selected accordingly.

With the most efficient air filters, certain air contaminants may deposit on tube surfaces. Also, a sooty, carbonaceous residue may result from decomposition of the cylinder lubricant. A moisture separator complete with automatic trap is an essential part of the inter and aftercoolers.

A supply of water for the compressor jackets is necessary. This water may be pumped from the evaporative condenser pan. However, it would appear desirable to use a closed water system to secure scale free jackets. Additional cooling surface may be provided in the evaporative condenser for this service and circuited for jacket water cooling.

Another article on this subject will discuss dehumidification of compressed air for obtaining greater efficiencies. ≠

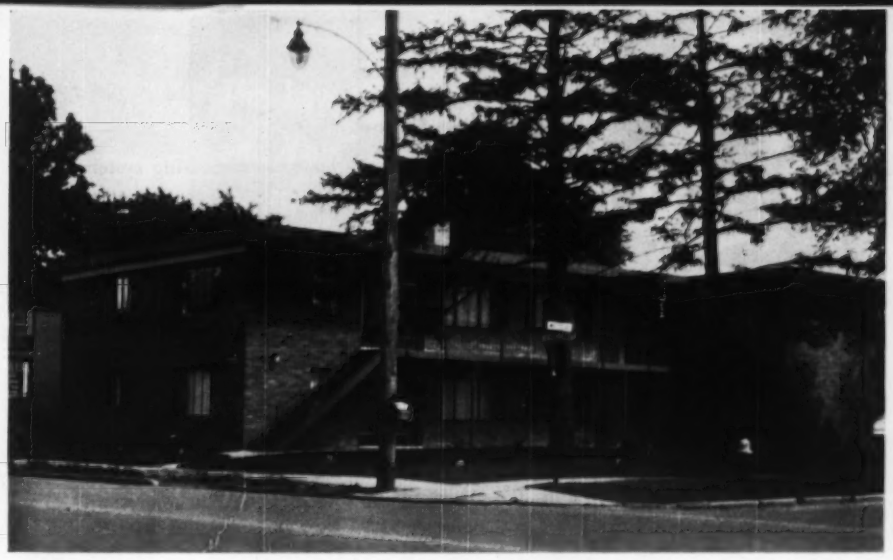


## IN SMALL APARTMENTS, MOTELS...

# Low Pressure Meets Varied

**System comprises conventional steam boiler, individual heater units installed in each room. Steam is delivered from mains to heaters via 3/8 in. copper tubing. Features include individual room control, easy installation.**

IN APARTMENT with basement, condensate return pump may be placed on floor, as shown here. However, in basementless building, pump pit is necessary so that entire pump can be installed below slab level



# Steam Zone System Heating Demands

BY PAUL S. AMBER and GEORGE H. AMBER
Amber & Amber, Consulting Engineers

Over the past few years one- and two-story multiple dwellings, garden apartments, terrace apartments, studio apartments, efficiency apartments, and motels have grown more and more popular. Heating these apartments and motels present common problems.

A careful study of the requirements (load variations, limited space for the system, and individual control) for these facilities has revealed that a low pressure steam (15 psi maximum) system provides very acceptable heating.

A conventional high output boiler is used to generate the steam. The steam travels through $\frac{3}{8}$ in. OD copper tubing to heater units in each room. Each heater unit is served by an individual copper tube delivering steam directly from the main. The capacities of heaters are 6000, 12,000, and 18,000 Btu per hr.

Usually, each room has one heater which includes a blower and thermostat. A $\frac{1}{4}$ in. OD copper tube carries the condensate from each of the heaters to the condensate return line back to the condensate return pump. The heater units provide filtered warm air from the steam convector by means of a steam driven blower which is controlled by a built-in thermostat.

Experience has shown that this type of zone heating system combines many desirable characteristics of conventional hot water and steam heating. The cost is also comparable to these conventional systems.

One of the most desirable features to the tenant is that each heater has its own thermostat which provides individual room temperature control. This feature has shown that fuel savings can be achieved also, since it reduces overheating.

Another advantage is that the piping is small and relatively easy to install.

### Calculate Heat Loss for Each Room

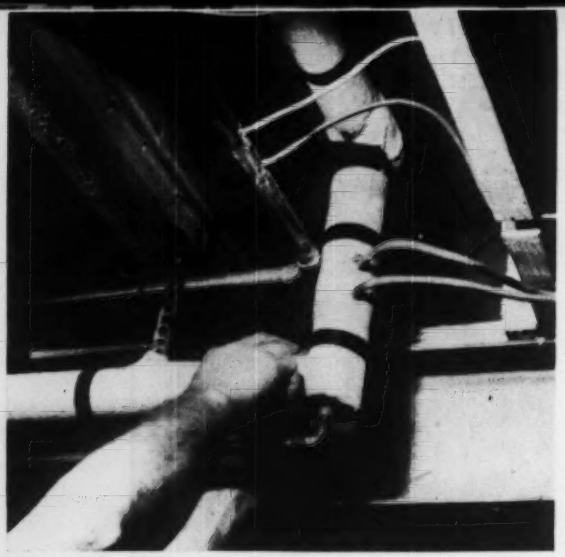
In designing the system, the heat loss for each room is calculated and the size of heater is selected accordingly. The built-in thermostat and modulating capacity features of the heaters greatly simplify their sizing. Each heater is capable of delivering any capacity up to its full rating by modulating the output determined by the selected thermostat setting.

When it is desirable to install a heater in an area planned for future expansion, it is advantageous to rough in its location by providing the lines and framing for the heater and then plaster over the opening. Then, as the heater becomes necessary, the plaster can be cut out and the heater installed.

### Distribute Warm Air Over Cold Wall

Wherever possible it is best to locate the heater so that the warm air will be distributed over a cold wall. In this way the maximum heat loss of the room is counteracted at the source, and drafts caused by cool air dropping off these areas is prevented.

To determine the heat output of the boiler, the maxi-



**STEAM LINES** must be insulated so that excessive condensation cannot occur that would interfere with smooth heater operation. Noninsulated line carries heater condensate back to pump. Each small tube delivers steam to one heater unit

mum capacities of all of the heaters are totaled. This will be in excess of the actual requirements for heating the building, but the extra boiler capacity provides a good heat pickup when starting the heating plant.

If the boiler is used also for heating domestic hot water, a larger size should be selected which would meet both the heating and hot water needs of the building. Hot water can be taken right from the boiler via a heat exchanger and tempering valve in buildings up to eight apartment units. Experience has shown that a storage tank is required for larger buildings.

A $\frac{3}{8}$ in. OD copper tube serves each heater. The cross sectional area of the mains must add up to about 50 percent more than the sum of the cross sectional areas of the steam lines to the heaters. This is necessary to allow for steam main water drip.

For condensate return, $\frac{1}{4}$ in. OD copper return lines are used from individual heaters. A return line that picks up condensate from two to four heaters is sized at $\frac{3}{8}$ in. OD. Tubing of $\frac{1}{2}$ in. OD is adequate to pick up from 4 to 8 heater returns. Condensate return totaling 300,000 Btu per hr can be accommodated by $\frac{5}{8}$ in. OD tubing.

Condensate lines that cannot be installed in outside walls (such as those that must pass building ells and door openings) must be in place before the concrete slab is poured. If the building has a basement or crawl space, this is not a problem. At this time it is also advisable to place the wooden box form for the condensate pump in the utility room.

Steam mains are never installed under the slab, as no advantages for doing this have been determined.

For new construction, a Class B flue is recommended instead of a masonry chimney. This Class B flue is adequate for both oil and gas fuels. These flues are relatively low in cost, take up less room (this is especially important when the vent is inside the building and must pass through a second floor apartment), and can be offset around rafters, headers, and partitions when necessary.

## Installation Follows Four Steps

The installation of this type of heating system can be divided into four stages.

1) *Preliminary work.* This includes planning and installing the copper tubing (such as the condensate lines that must be placed under the floor slab) that goes into the building before it is closed in.

2) *Inside roughing.* The steam mains, feeders, and the condensate lines that are placed into the framework of the building.

3) *Trimming.* Of the boiler, condensate pump, valves, automatic controls, etc.

4) *Heater installation.* The heating units installed in each room, and the system placed in operation.

## Provide Condensate Return

These heaters must discharge the condensate into atmospheric pressure, so a condensate return pump must be used. An optional system component is a steam driven pump adequate for apartments with up to six units.

For apartments larger than six units, an electrically driven condensate return pump must be used. As the condensate flows to the pump by gravity, the pump must be lower than the return lines. This is easy in a building with a full basement, in which case the pump is set on the basement floor behind the boiler. In basementless buildings, however, it is necessary to have a pump pit, so that the entire pump can be below the concrete slab level. To make sure that the pump pit is large enough, a wooden boxlike form of the right size is provided to be sure that it is flush with the slab grade.

Rubber hoses and unions are used in connecting inlet and outlet lines to the condensate pump so that the flow rate may be checked. These will also isolate any vibration from the lines.

Once the building is framed, the concealed steam and condensate return lines are installed, making sure to allow room for the steam mains to expand. This is done by letting them ride free in joist holes on y-block supports. The tubing branch lines are taken off in a generous sized gooseneck to allow for some movement.

It is important to insulate the steam mains, as water in the lines, due to excessive condensation, interferes with smooth heater operation. After testing all joints for leaks, lathing can take place. The heater units are installed after the plaster is finished.

If heat is necessary during construction, one heater unit per apartment can be installed and the system steamed up. For this temporary heating, all cover grilles are removed and packed. The thermostat is protected with tape until after final painting is completed.

The condensate pump returns should not be connected until after the job is finished. It is a good idea to waste the condensate water for a while to get dirt, dust, sand, and sawdust out of the system. It is also suggested that the boiler be flushed. However, boiler cleaner and antifoaming chemicals should not be used excessively. ≠

**The Law and Your Profits**

BY WILLIAM HURD HILLYER

# *Remedy, Liability* Not Synonymous

LEANING too heavily on conversations does not further one's cause in court. This is particularly true in connection with a mechanic's lien involving real estate, as is illustrated by the following two cases.

Subcontractor Tewbula, doing business as Tewbula Piping Co., sued Freholdar in equity to foreclose a claim of lien against property owned by that defendant. He did not name as party defendant the general contractor, Mayn & Mayn, with whom Freholdar had signed an agreement for the erection of a building on his property and who had, in turn, subcontracted the piping work.

In his suit Tewbula claimed the right to recover the full amount of his lien on grounds that before he had completed the contract he had told Freholdar that he had received no payment. Tewbula said that Freholdar had promised to make payment in full direct to him. This allegation was denied by Freholdar.

The chancellor in the court of equity held that the general contractor was an indispensable party defendant and should have been so named by the plaintiff. For that reason Tewbula's suit was dismissed.

The subcontractor appealed his case to the state supreme court.

"On the law and the facts . . . a decree for the plaintiff is required by justice and right," Tewbula urged before the higher court. He argued that he was entitled to the full amount of his lien because the defendant-owner had "blatantly" violated the mechanic's lien law by failing to obtain a performance bond and by making payments to the general contractor that were "improper under his contract and under law."

The supreme court in reaching its decision trod a thorny path of cited opinions—most of them construing state statutes. To begin with, the court held that there was no "privity" (private understanding) between parties so as to justify awarding the subcontractor the full amount of his lien. While holding that quick enforcement of statutory liens is available to a "laborer" (a subcontractor, in this case), the court ruled that the general contractor was not an indispensable party to a suit by a subcontractor seeking to foreclose a mechanic's lien acquired and perfected under statutory law.

The court rejected Tewbula's claim respecting "the law and the facts" as "insufficient," and as "not cured by a more particular statement in the brief." Furthermore, the court drew a distinction between *remedies* as provided by one statute and the *liability* of the owner for a lien acquired and perfected under a later statute.

In view of these citations, all of them technical and some of them contradictory in effect, the court reached an ambidextrous conclusion. It returned the case to the lower court "for further proceedings not inconsistent with the opinions herein expressed." Meanwhile, Tewbula was to wait for his money.

What blocked his claim, and may in the long run void it entirely, was his failure to establish a clear and unequivocal "privity of understanding" with Freholdar. His mere recital of conversation between parties, without supporting evidence, did not carry weight in court. He likewise failed to grasp the principle that to invoke a legal remedy does not of itself make the other party liable.

Another recent case offers a further example of the extremely technical aspects of mechanic's lien procedure, both in law and in equity.

A subcontractor sued to foreclose a materials supplier's lien against an owner of property. The owner had given the general contractor a portion of his final payment under a contract without first securing a sworn statement from that contractor.

The state supreme court held, on appeal by the subcontractor, that he and other unpaid mechanics and suppliers had rights to liens for their shares of the full amount of such final payment. That is to say, this right was not merely to the extent of the contract price remaining in the owner's hands after job completion.

However, the subcontractor's contention that the "initial" and "progress" payments made by the owner to the general contractor were improperly made to him and that the subcontractor should therefore share in them was disallowed.

This was because the act on which the contention was based had been declared void in a previous legal decision. Consequently, as with Tewbula, the case was "remanded with directions" to the lower court, and the subcontractor's money was tied up accordingly. ≠

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WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

*This series presents actual cases. All names are, however, fictitious. It should, of course, be remembered that laws vary in different states.*

# How to Prevent Weld Failures In Nuclear Power Piping

**In the May and June issues the authors described some of the inspection techniques that are used for nuclear piping, and related the causes and cures for thermal failures. This article discusses welding fabrication techniques for heavy walled piping, with special emphasis given to the different backup techniques, the necessity of proving the integrity of the root pass, and the importance of heat treatment of welds.**

BY V. T. MALCOLM
Engineering Consultant

and

SIDNEY LOW
Director of Research
Chapman Valve Mfg. Co.

THE READY ACCEPTANCE of chromium nickel austenitic stainless steels by engineers engaged in the design of piping systems for steam, oil, chemical, and nuclear power installations is evidenced by the use of these steels to meet the requirements of service.

In the use of these steels for piping, fabrication by welding is necessary and a sufficient amount of information is available to insure sound welds. Much of this information has been released only recently, however, due to security regulations.

During the past few years specifications have been devised and used to cover the application of welding for nuclear power piping and other components. Several such specifications were reviewed to determine the provisions needed for evaluating:

1) The adequacy of procedure to accomplish both the general welding required in a given application and the production of a particular joint design using specified materials

2) The competence of the welder.

Practically all of the specifications had the following minimum requirements:

1) The American Welding Society standard qualification tests generally as modified by Section IX of the American Society of Mechanical Engineers Boiler and Pressure Code

2) Individual certification of both procedure and welder for each specific joint design

3) Qualification on the basis of specific material combinations to be used in actual production welding of a given joint (rather than accepting qualifications based on any one of a large variety of materials in a given *P* number or *F* number grouping as permitted in Section IX of the boiler code)

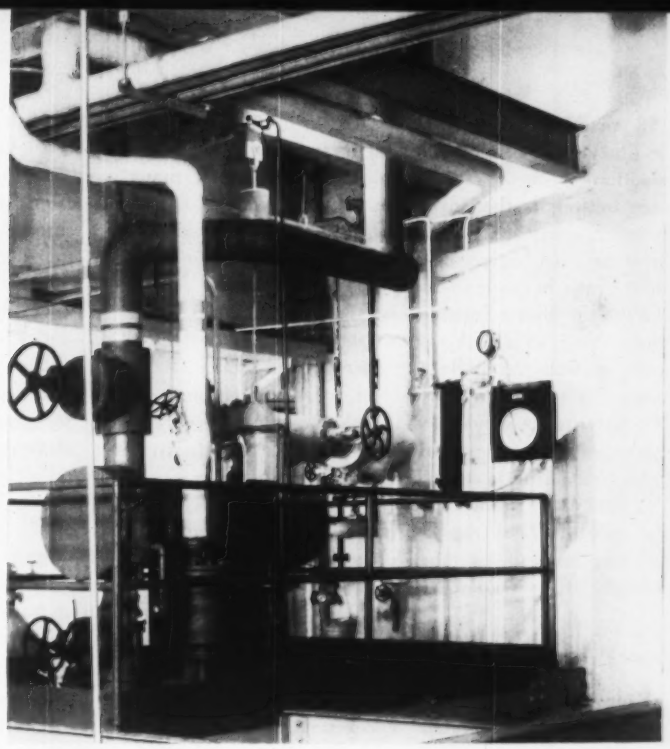
4) The requirement that test specimens pass the nondestructive tests required for production welding in the piping system to which the procedure is applicable.

In general the qualification test requirements appeared consistent with the inspection requirements which were ultimately placed on production welds made in accordance with procedural specifications, even though there was a considerable variety of such inspection requirements. One such requirement was that weld repairs cannot be made if more than one-half of the depth of the wall thickness is cut out.

In the matter of joint design, individual qualifications were required for fillet joints and for groove butt joints using consumable backing rings, integral backing, no backing rings, and double welding. The qualification of these individual joint designs generally involved the use of base metal of the same composition and thickness required for production welds. It was common to require that test welds be subjected to and meet the nondestructive requirements of liquid penetrant, radiographic, visual, ultrasonic, and magnetic particle inspection.

Special requirements involved the use of a larger number of conventional tensile and bend test specimens, the use of metallographic cross sections for the qualification of welders, as well as procedures, trepanning, weld probing and the occasional removal and destructive examination of a welded joint in its entirety. In some specifications quality control specimens produced intermittently during the actual welding of a joint have frequently been required in nuclear power piping.

*This article is abstracted from a paper presented at the 1958 Nuclear Congress held recently in Chicago.*



NUCLEAR ENERGY applications, such as are carried on at Argonne National Laboratory, demand exacting pipe welding techniques to prevent failure under rugged operating conditions. Procedure must be proven, as must competence of welder

If the basic philosophy for weld inspection is adopted that each individual joint involving specific dimensions, base metal, and size and composition of weld rod be separately qualified (the number of essential variables increased and the scope of each narrowed), and that the same nondestructive test as required for production welds be applicable to test welds, it appears that the standardization of welding procedure and welder qualification can best be effected through standardization of joint design, material selection, and production inspection requirements. A qualification procedure might contain:

1) The basic requirements of MIL and ASME code qualification tests

2) Individual procedural qualification of joints which are significantly different in design or geometry on the basis of actual materials to be used in production welding

3) The added use of the nondestructive tests to be applied to production welds

4) Qualification of welders according to requirements from procedural qualification (rather than merely on the basis of present code requirements for qualification of welding operators)

5) A more careful record and inspection to properly see that welders doing the work are properly certified.

### Require Different Backup Techniques

In nuclear power piping systems where fabrication by welding is used to construct a complete unit, the joint backup on wall thickness 5 in. and greater present quite a problem. With such thicknesses, welding requires a complete change in backup techniques.

The design of the joint itself, the backup methods, and the degree of restraint must all be taken into consideration as individual problems. Sometimes it may be necessary to use chill plates in welding, properly located backup bars, gas backup, and proper supports to protect the unit against bending action that would cause cracking in the weld.

In austenitic chromium nickel stainless steels, heavy welds may exhibit fairly heavy "neckdown" of the base metal adjacent to the weld. It might be presumed that plastic flow has materially reduced any effect that might be expected from welding stresses.

An increase in mass of base metal increases both the restraint of the weld and the cooling rate of the heated metal. Such a heavy weld is more subject to high residual stresses because the thicker base metal yields less to the force imposed on it by the contracting weld metal. If proper precautions are not taken, the weld may become distorted and have high residual stresses. For a given weld, the greater the percentage of weld that has been completed, the closer the rigidity and strength of the weld approaches that of the wall of the base metal thickness and the lower the unit stress in the weld.

It is not unusual for nuclear power piping systems to include heavy walled piping. With the limited access to welds in such piping, and with the configuration and complicated sections of the primary loop, selecting the method for radiographing production welds is acute. This is particularly true as to the radiographic source that will denote the penetrameter having a depth equal to or less than 2 percent of the wall thickness. It is apparent that isotopes must be used, but difficulty is often experienced due to nonstandardization of the focal spot of the isotope source.

If possible, the source should be inside the pipe, with the film on the outside. This method simplifies the interpretation of these radiographic studies, and in many cases outweighs the advantages of high voltage x-rays. However, sometimes limitations on diameter to thickness ratios have an important bearing on the image, and one could argue in favor of high voltage x-rays.

With the source outside and the film on the opposite outside wall, it is necessary to shoot through two thicknesses of wall. With the heavy single wall section, it becomes difficult to properly interpret the radiograph.

If the film is inside and the source outside—so as to obtain the minimum focal length required for thickness—the film inside is severely curved and the edges of the film run away from the source rather than toward it. The wall thickness rapidly increases from the center of the film, and the number of exposures is greatly increased.

### Must Prove Integrity of Root Pass

Even if it slows down the work of production welding, it is felt that it is absolutely necessary to prove the integrity of the root pass. The completed root pass should be inspected by fluorescent penetrant oil methods and/or radiographed. The weld should be inspected again in this manner at one-third the depth of the weld, two-thirds the depth of the weld, and finally the completed weld. By using this technique, poor welding can be determined before more layers are put on. As a result the piece can be properly repaired.

In the welding of joints certain electrical instruments have been employed to measure the aberration of the arc continuity which changes the correct cadence of the metallic particles transferred through the arc stream often resulting in the physical defects in the weld. Any sort of disturbance over an appreciable length of time indicates the possibility of a cavity, slag inclusions, and/or lack of fusion. With such electrical instruments a graphical record indicates the uniformity of the arc stream and gives the inspector an idea as to the quality of the weld and the skill of the welder.

During the past years it has been noted that "weld prober" sampling might be used as a nondestructive test in the inspection of welds. While this method of test does not afford 100 percent inspection, it does supplement ultrasonic and radiographic inspection in the following respects:

1) Ultrasonic inspection of the entire weld should be used initially; and if areas of discontinuities are noted, the weld prober is used to give a spot check of the defective section

2) The specimen removed by the weld prober enables the inspector to obtain a good visual examination.

3) The weld prober provides a specimen that can be polished and etched for metallographic examination; and if so desired, a check can be made as to whether the metal is being deposited in accordance with specific welding procedures.

4) It provides a sufficient amount of metal for making a bend specimen across the weld.

In use, the weld prober removes a "boat-like" specimen from the weld that can be stopped short of cutting through the pipe wall. The device is a precision machine tool which is clamped around the pipe and cuts in from opposite directions with a special saw having a spherical curvature. The machine permits accurate cutting to the desired depth without cutting through the pipe wall.

The weld prober has been used for a number of years and is used extensively for checking steam power piping for graphitization. It is felt that it can be applied to nuclear power piping as an important inspection procedure.

### Heat Treatment of Welds

The AWS Recommended Practice for the Heat Treatment of Austenitic Chromium Nickel Stainless Steel states that:

1) No heat treatment is required after welding:

a) Where corrosion resistance in the as welded condition is found to be adequate

b) Where strength and ductility are a primary service requirement; and in the absence of serious stress concentration

c) In relatively thin weldments.

2) The weldment should be heated to a minimum of 1800 F, followed by rapid cooling:

a) Where dimensional stability must be assured

b) For maximum corrosion resistance

c) Where improved mechanical properties are required.

Immunizing treatments are sometimes applied to completed welded structures before service. Such a treatment consists of heating the weldments to 1500 F so that chromium diffuses into the depleted areas and the carbides coagulate. By this treatment an attempt is made to break up the continuous path of carbides formed during the welding operation so that intergranular corrosion does not occur. It is by no means a satisfactory treatment and at best is only partially effective. It is used only in locations where the full 1800 F treatment and rapid cool cannot be used.

It is beyond the scope of this article to discuss residual stresses, stabilizing elements, sigma and other phases, hot ductility, weld decay, electrodes, and many other factors entering into weld procedure. However, it is necessary to have inspection procedures which will detect cracking, fissures, porosity, lack of fusion, craters, carbide precipitation, slag inclusions, lack of penetration, etc. It is further necessary to qualify welders as to welding joint types and to determine that the joint has been properly designed for weld geometry and that joint preparation and backup procedures are correct. The inspector should further see that shrinkage, distortion, and restraint do not take place so as to maintain the dimensional stability required and that the proper heat treatment of the joint be determined and carried out as well as inspection of filler rods to be used on joint welding. ≠

# How to Cut Cooling Costs

***68 tips on how to save on cooling costs are listed here. How efficient is your system? If you can benefit from none of these suggestions you indeed have a superb installation.***

BY WILLIE HAMMER
Chief, Heating and Fuel Units
Engineering Div.
HQ, U. S. Army, Japan

1) Make certain that natural and mechanical ventilation are inadequate before considering a chilled air system.

2) When using natural ventilation in a room with cross ventilation, for better effect, have windows on the low side of the wall in the direction from which wind is blowing, and on the high side of the opposite walls.

3) Use trees, bushes, awnings, roof overhangs, or other shields to keep the rays of the sun from hitting the outer walls of conditioned spaces.

4) Use light colored venetian blinds, curtains, or draperies to reflect the sun's rays back out through windows.

5) Use light colored reflective outer walls and roofs to reduce absorption of heat from the sun by radiation.

6) Use fans and blowers to correct stratification of air and to eliminate stagnant areas in which air does not circulate.

7) Where mechanical ventilation only is provided, use high ceilings to permit dissemination of heat.

8) Use fluorescent instead of incandescent lighting.

9) Operate heat producing equipment in occupied spaces as little as possible. Vent this equipment to the outdoors.

10) Provide air conditioning only to spaces that actually require it. Concentrate activities in and provide refrigerated cooling for smallest possible areas. Block off air conditioned areas from those not conditioned. Use hoods, booths, false ceilings, or small structures within large ones to hold cooled air where desired.

11) Keep temperature of air conditioned spaces within the limits specified.

12) Provide fans to replace heated air in upper areas with cooler outside air.

13) Install vapor barriers to prevent entrance of moisture into conditioned spaces.

14) Provide insulation and covers on open vats or storage tanks containing heated liquids in conditioned spaces in order to reduce heat transfer and evaporation of moisture.

15) Eliminate or reduce use of water in cooled spaces to minimize evaporation and subsequent increase of humidity.

16) Use water sprays and ponds on roofs to reduce heat absorption.

17) Keep doors and windows to air conditioned spaces closed. Replace broken or missing window panes. Caulk or weatherstrip window and door frames to prevent entrance of warm air.

18) Use insulating glass, multiple glazed windows, or heat absorbing glass to reduce heat gain.

19) Minimize excess ventilation in spaces cooled by refrigeration.

20) Use revolving or self-closing doors or provide vestibules to reduce entrance of warm air into conditioned spaces.

21) Close openings to basements, stairwells, and elevator shafts which are not air conditioned. Make certain that fireplace chimneys are closed when not in use.

22) Orient the building to require the smallest cooling load possible. If practicable, have the sides of the building with the largest glass areas receive the smallest amounts of sunlight.

23) Insulate cold air ducts located in warm spaces.

24) Insulate domestic hot water or process steam lines which pass through cooled spaces.

25) Make certain that chilled water distribution systems are well insulated to reduce heat gain. Check to make certain that any such piping does not run close to heat producing equipment or lines unless heat transfer is minimized.

26) Make certain that insulation does not become saturated with moisture which will reduce its insulating value.

27) Make certain that fans and blowers are rated, properly maintained, and adjusted to meet the requirements of the particular system.

28) Make certain that fans operate at or near their peak efficiencies. Effort should be made to minimize noise and vibrations to reduce the energy lost as sound.

29) Keep air conditioning ducts clean and free of obstructions. Make certain that seams of air

*The author has compiled a similar list of ways to cut heating costs. This list appeared in the January issue.*

Tear out along this line

HPAC DATA SHEET

ducts are tight. Caulk and seal with compound where necessary.

30) Make certain that distribution systems are balanced and that duct, grille, and register sizes and openings are large enough to handle required amounts of air. Make sure that grilles and registers are in good operating condition.

31) Be sure that the cold air outlets are located so as not to cause drafts or other discomfort to room occupants.

32) Use zone controls in large buildings or for areas requiring different temperatures.

33) Use cold water from wells, streams, lakes, or municipal water systems to provide initial cooling capacity and mechanical refrigeration for the remainder.

34) Where well water has been used for cooling, check to see if water from municipal systems is obtainable at lower costs. Also check to see if the reverse is true.

35) Use water for cooling purposes before using it for process work.

36) Check cooling water supply to make sure the quantity is sufficient and that its temperature is not too high.

37) Treat cooling water to prevent accumulation of scale or algae in the condenser coils and cooling towers.

38) Use cooling towers or spray ponds to permit re-use of water.

39) Use evaporative condensers to reduce amount of cooling water required.

40) Locate cooling towers and evaporative condensers where maximum effect of winds can be obtained.

41) Where dehumidification only and not cooling is required, investigate the possibility of using chemical dehumidification.

42) Investigate the economic practicability of using a heat pump.

43) If water and high pressure steam are available at low cost, check to see if the installation of a chilling system using a steam ejector would be more economical than an electrically driven compressor. If water and steam are relatively high in cost, the reverse might be true.

44) Recirculate cool, dry air from conditioned spaces wherever practicable.

45) Make sure that heat transfer characteristics of fins on cooling coils are not adversely affected by presence of dirt, and that air passages to and between fins and coils are not blocked.

46) Investigate the possibility of increasing system efficiency and refrigerating capacity by subcooling the refrigerant by external means such as cold water.

47) Make certain that air conditioning and refrigeration equipment are properly ventilated and that air passage is not obstructed.

48) Use the type of refrigerant for which the equipment was designed.

49) Check equipment regularly for refrigerant leaks with a leak detector as part of a sustained maintenance program. Keep records of refrigerant replacement to indicate whether or not there is excessive or steady loss.

50) Make certain that all moisture and air which might cause malfunctioning has been purged from the refrigerant system.

51) Be sure that cooling and condensing coils and liquid receivers are not excessively large, requiring greater than necessary charges of refrigerant. Coil capacities should match that of the compressor under normal operating conditions.

52) Keep length and size of refrigerant piping to a minimum.

53) Re-use refrigerants removed from equipment that is being repaired.

54) Be sure liquid receiver is never in direct sunlight. Use shade to reduce solar heat.

55) Use power meters to determine loads on equipment to make certain it is not overloaded and to assist in determining power requirements and costs of operation.

56) Prepare power targets based on degree days encountered. Check against actual usages.

57) Install maximum and minimum thermometers in cooled areas to indicate what temperatures are, and have been, and to determine costs of operation to see if savings can be effected by installation of additional equipment or insulation.

58) Check thermostats to be sure they are properly located.

59) Shut off equipment when it is not required.

60) Institute a monitor system to make certain that cooling effort is not wasted.

61) Check controls to make certain that they operate correctly within their set limits.

62) Check pressure cutouts to be certain they are set properly. A low pressure control set too high or a high pressure control set too low will cause continuous short-cycling of the compressor.

63) Prepare maintenance schedules well in advance to provide time for procurement of necessary supplies and to permit optimum use of men and equipment.

64) Keep filters, strainers, and scale traps clean.

65) Check compressor valves and pistons to be sure they do not leak, do not stick, and are well lubricated.

66) Be sure that the expansion valve is adjusted and operates properly.

67) Make certain that operators are instructed in the best methods to use their equipment, in accordance with the manufacturers' instructions.

68) Have all operators, operations, and maintenance work supervised by competent personnel. ∓

HEATING, PIPING & AIR CONDITIONING

# JOURNAL SECTION

OF

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

## CONTENTS

President's Message
Schedule of Events for Merger ..... 112

Annual Energy Use for Electric Space Heating
By R. L. Boyd ..... 113

Omni-Directional Low-Speed Hot-Wire Anemometer
By J. F. Kemp ..... 117

Heat Gain Through Windows Shaded by Metal Awnings
By Necati Ozisik and L. F. Schutrum ..... 121

How Research Can Improve Performance of Fibrous and Reflective Insulation
By William Turbeville ..... 126

A New Method for Calculating Radiant Exchanges
By Benjamin Gebhart ..... 131

Surfacings for Glass Fiber and Foam Thermal Insulation
By W. P. Ellis ..... 136

Activities of Society Chapters ..... 140

Candidates for Membership ..... 146

Obituaries ..... 147

Council and Council Committees, Advisory Board, General Special, Nominating Committees, and Society Organization Personnel ..... 148

# President's Message

## Schedule of Events for Merger

An early decision concerning the proposed merger of the Society with ASRE is highly desirable. With this in mind, a tentative schedule has been prepared. I am outlining it here in order that everyone may know how the timing and the sequence of events is expected to work out.

The first step was the presentation of the recommendations of the Committee on Co-operation to the Councils of the two societies for consideration at the time of the Semi-Annual Meeting of the Society in Minneapolis.

The second step is scheduled for July 15th. It consists of distributing copies of the detailed plan as approved by the two Councils, together with tentative By-Laws, to the members of the Society Council, to members of the Advisory Board of the Society, and to each chapter president.

It is also expected that the Society legal counsel will draft a finished set of By-Laws to conform to the details of the Plan in the form approved by the two Councils.

It is believed that having the Council-approved Plan and By-Laws completed by mid-summer will provide ample time for all chapters to discuss it thoroughly at regular chapter meetings in September, October, and November. Officers and Regional Directors stand ready to assist in helping chapters and members in their consideration and discussion of the approved Plan.

With the discussion period provided and with members having had time to consider the Plan, the third step is to call a Special Meeting of the Society for a membership vote on the Plan about December 1 or 2, 1958.

About 40 days prior to that date, or about October 20, an announcement of this Special Meeting will be mailed to each member eligible to vote. This notice will state the object of the Special Meeting and will be accompanied by a brochure setting forth details of the Plan and the new By-Laws. Each member will be urged to consider the Plan with care and to vote at the Special Meeting either in person or by proxy.

It is also to be noted that a two-thirds majority of those voting in each society is necessary to permit adoption of the Plan by the respective groups. Also, following such a favorable vote by the members of the two societies, the Plan can become effective following consideration and approval by the Courts of New York.

E. R. Queer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*Information on other Society personnel can be found on page 148.*

# Annual Energy Use for Electric Space Heating

By R. L. Boyd†, Pittsburgh, Pa.

**SUMMARY—Use of electrical energy for space heating is increasing. Data are included taken from operating results experienced in installations where electric space heating is in use. Methods of estimating annual energy needs are discussed. It is concluded that formulas developed for combustion fuel requirements result in high estimates when applied to electrical heating, and that the reasons for this situation should be investigated, since there is need for a method which will yield estimates in agreement with experience records.**

THE IMPRESSIVE increase in use of electricity for space heating of residences, as well as commercial and industrial establishments, merits close analysis of this type of energy by heating engineers. This paper presents typical data on electric heat installations and brings out definite differences in quantities of energy required for operation as compared to estimates for conventional heating systems.

Despite the fact that upwards of half a million residences now use electricity as their sole source of heating, authentic data on the operating characteristics of electric heating systems have not been generally available. The examples presented here emphasize the need for study of such characteristics with adequate instrumentation to permit proper evaluation of the data and establishment of standards for estimating the energy consumption of electric heating systems.

Evaluation of combustion heating systems has been largely devoted to determination of useful heat delivered to the space compared to the heat value of the fuel input. With resistance electric heat, determination of such efficiency is unnecessary as conversion of electricity to heat is at 100 percent efficiency and heaters are most frequently located within the spaces being heated. As with other heating means, the selection of type of electric system should be based upon: (*a*) choice of appearance; and (*b*) evaluation of such characteristics as air movement, proportion of radiant and convected heat, visible light emissivity, quietness of operation and operating temperatures.

In Fig. 1, a plot of fuel costs in principal cities of the United States[1] shows a wide range of costs per million Btu of delivered heat for various conventional fuels, and for electricity at unit costs per kwhr well below usual residential electric rates. The efficiencies used for combustion fuels are stated in the source referenced. The costs for electric heat are based on 100 percent efficiency. While this chart indicates that electricity at 3/4 cent per kwhr is not competitive with fuels generally, experience records, and the growth of electric heating, have demonstrated that it is competitive, even at 1 3/4 cents per kwhr. Because of the wide variation in fuel and electric energy prices due to local conditions, this paper discusses energy requirements since they may be converted to costs by application of local prices.

The conventional methods of estimating fuel consumption have been developed based on use of combustion fuels. Over the years, these methods have been refined so that they yield close estimates, generally, when used with the fuels on which they were based. They are highly inaccurate when used for electric heat intelligently applied, although they are not so far in error when electric heat is applied to uninsulated or poorly insulated structures. When electric heat is applied on a room-by-room basis to structures properly insulated for an economic balance between first cost and operating cost, conventional estimating methods indicate much more energy required for heating than is shown by available consumption records. This is perhaps partly due to disregard of the internal heat and sun effect which carries a higher proportion of the heating load in the better insulated building, regardless of the heat source used. The influence of internal heat and sun effect is evidently more significant when a number of thermostats control the heat in each room than with a system regulated from only one central point.

Although the length and severity of the heating season varies with the locality, analysis based on one particular area may illustrate the internal heat influence. As an example, assume a typical 1000 sq ft floor area, brick veneer residence with 8 ft, 3-in. ceiling height, 200 sq ft combined glass and door area, 872 sq ft net wall area and well-vented attic and crawl spaces. The calculated effect of insulation on the capacity required to heat such a residence is shown graphically in Fig. 2. Assume further that 400 kwhr per month of electrical use represents uses releasing heat within the residence and contributing to desired heating 9 months of the year. Based on Fort Wayne, Ind., with 80 deg temperature difference (−10 F design) and 6,287 degree-days, and using the calculated heat

†Product Manager, Commercial Comfort Heating Division, Edwin L. Wiegand Co. Member of ASHAE.

[1]Exponent numerals refer to References.

For presentation at the 65th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Philadelphia, Pa., January 1959.

loss method in THE GUIDE* to determine the annual requirement for heating, the first 7 columns of Table 1 are developed for the progressive stages of insulation indicated (all steps of insulation are in addition to all preceding steps of insulation).

Comparison of the net kwhr required to heat the residence with the gross calculated kwhr indicates that the internal load contributes from 5 to 19 percent of the calculated heat loss. This has been indicated in previous studies.[2] But actual experience records show that an even more significant deviation from calculated energy requirement is experienced. For example, the last column of Table 1 gives the calculated energy requirement based on the formula recommended by the *National Electrical Manufacturers' Association*[3] using a value of 18.5 for C.

$$\text{Annual kwhr Consumption} = HL \times DD \times C/TD$$

*where*

$C$ = a constant (variable 12 to 24).
$HL$ = heat loss of building, in kw.
$DD$ = annual degree-days for the locality.
$TD$ = design temperature difference.

The constant used in the *NEMA* formula was developed from experience records as were the constants used generally for combustion heating calculations, and even the 18.5 constant (which indicates that about 29 percent of the calculated heat loss is contributed by other sources than the heating system) has given conservatively high energy requirements generally. Experience shows that the formulas developed for predicting fuel consumption of combustion heating systems are not applicable to electric heating without excessive error.[4]

Properly instrumented examples of actual experience records for electrically-heated spaces are difficult to find. Those available are frequently

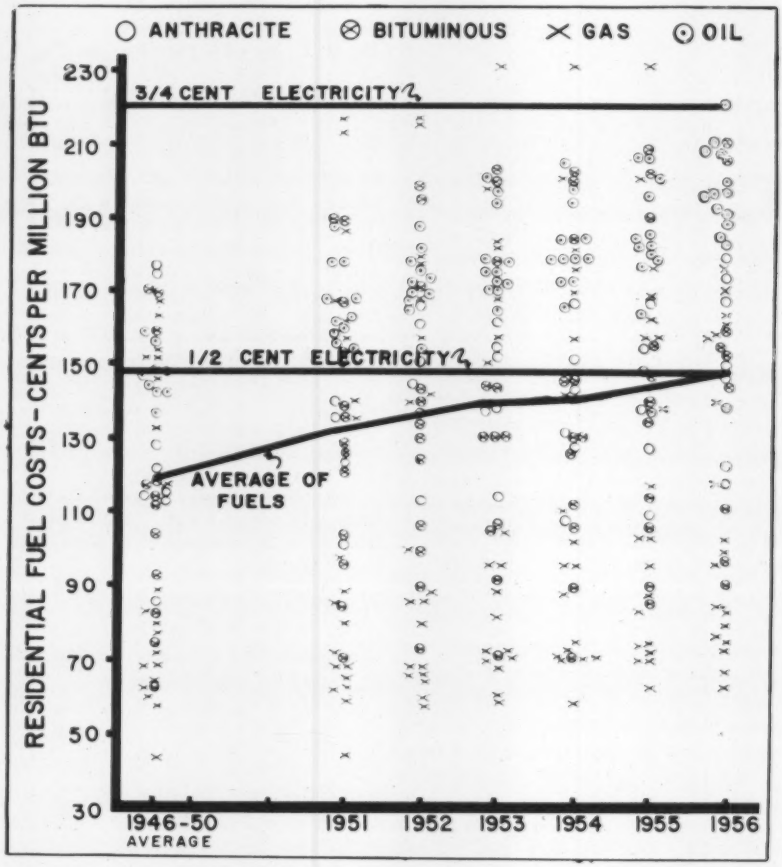



**Fig. 1 — Plot of fuel costs in principal U.S. cities in recent years, with average and 2 stated electric rates super-imposed**

attacked as having been developed by groups vitally concerned that experiences cited will be favorable to electric heat. The experience records referred to herein are actual meter records, but lack desirable detail regarding conditions of operation and sponsorship of a duly recognized Society or committee of such a group. The Appendix, Table A-1, gives *monthly* electrical energy consumption of 10 residences which Table 2 summarizes, illustrating typical results of electric heating installations.

Fig. 3 shows graphically the information in the last 4 columns of

**Table 1 — Effect of insulation on heating capacity required in a typical 3-bedroom house**

| Construction | Load, kw | Heating % of Uninsulated | Annual kwhr to Heat by Calc. Heat Loss | Internal Heat, kwhr | Net kwhr to Heat | Percent of Calc. Heat Loss | *NEMA* Manual Energy |
|---|---|---|---|---|---|---|---|
| Uninsulated | 36.6 | 100 | 75,419 | 3600 | 71,819 | 95 | 55,212 |
| Plus 3 in. on ceiling | 24.1 | 66 | 49,661 | 3600 | 46,061 | 93 | 35,038 |
| Plus 2 in. on wall | 20.6 | 56 | 42,449 | 3600 | 38,849 | 92 | 29,950 |
| Plus 2 in. on floor | 14.9 | 41 | 30,704 | 3600 | 27,104 | 88 | 21,663 |
| Plus 1 in. on flr. & wall | 13.7 | 38 | 28,251 | 3600 | 24,651 | 87 | 19,918 |
| Plus storm glazing | 10.0 | 28 | 20,606 | 3600 | 17,006 | 83 | 14,539 |
| Plus 3 in. on ceiling | 9.4 | 26 | 19,370 | 3600 | 15,770 | 81 | 13,666 |

*HEATING VENTILATING AIR CONDITIONING GUIDE 1958, p. 467 (published by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, New York, N. Y.).

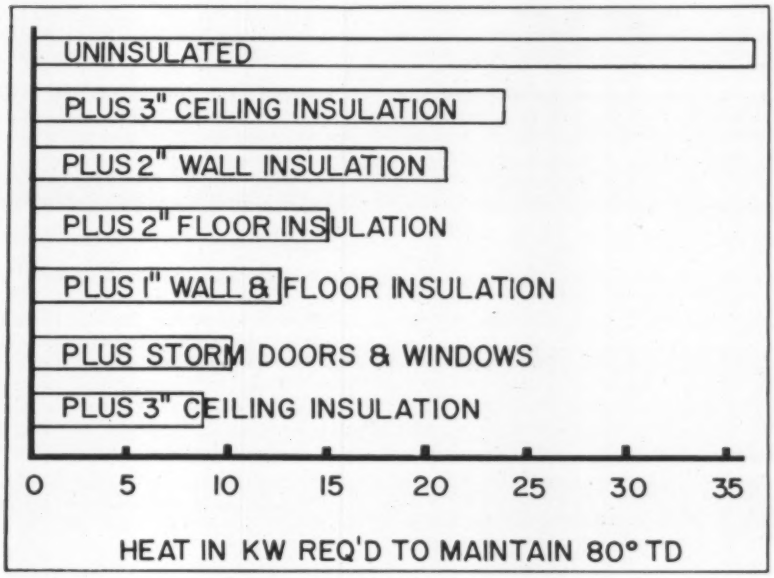

UNINSULATED
PLUS 3" CEILING INSULATION
PLUS 2" WALL INSULATION
PLUS 2" FLOOR INSULATION
PLUS 1" WALL & FLOOR INSULATION
PLUS STORM DOORS & WINDOWS
PLUS 3" CEILING INSULATION
0 5 10 15 20 25 30 35
HEAT IN KW REQ'D TO MAINTAIN 80° TD

**Fig. 2 — Illustration of how addition of successive insulations affects electric energy requirement (based on a 3-bedroom house)**

**Table 2 — Electrical energy consumption of electrically heated residences**

| Identification | Locality Indiana | Floor Area | Kilowatt-hours consumed | | | Estimate in General Use In Locality,[b] kwhr |
|---|---|---|---|---|---|---|
| | | | Total | Non-Heating | Heating | |
| Cotes | Ossian | 1076 | 17,010 | 5,580[a] | 11,430 | 9,325 |
| Cohran | Bluffton | 1200 | 19,238 | 9,864[a] | 9,374 | 10,400 |
| Fechter | Bluffton | 1120 | 13,856 | 4,608[a] | 9,148 | 9,707 |
| Heline | Ossian | 1300 | 11,740 | 720[a] | 11,020 | 11,267 |
| Moper | Ft. Wayne | 1200 | 15,718 | 4,992[a] | 10,726 | 10,400 |
| Shoyer | Ft. Wayne | 1400 | 15,722 | 6,372[a] | 9,350 | 12,133 |
| Gohert | Ft. Wayne | 1100 | 24,796 | 13,932 | 10,864 | 9,634 |
| Hoard | Ft. Wayne | 1500 | 22,460 | 8,344 | 14,116 | 13,000 |
| Gee[c] | Columbia City | 904 | 16,730 | 7,849 | 8,881 | 7,855 |
| Dufey[c] | Columbia City | 904 | 14,400 | 6,594 | 7,806 | 7,855 |

[a]Non-heating use estimated by multiplying sum of July and August energy consumption by 6.
[b]Estimated, based on 8 2/3 kwhr per sq ft floor area.
[c]Identical houses, next door neighbors. Dufey, couple only; Gee, couple and 1-year-old baby.

Table 2. Listing of many times the examples given would be no more conclusive. The examples tabulated include instances with energy consumption over and under the general experience of the area, with the last 4 selected for actual sub-metered data on the heating consumption. In comparing individual cases, it may be concluded that personal living habits influence costs more than weather deviations or assumptions made in setting up the estimates.

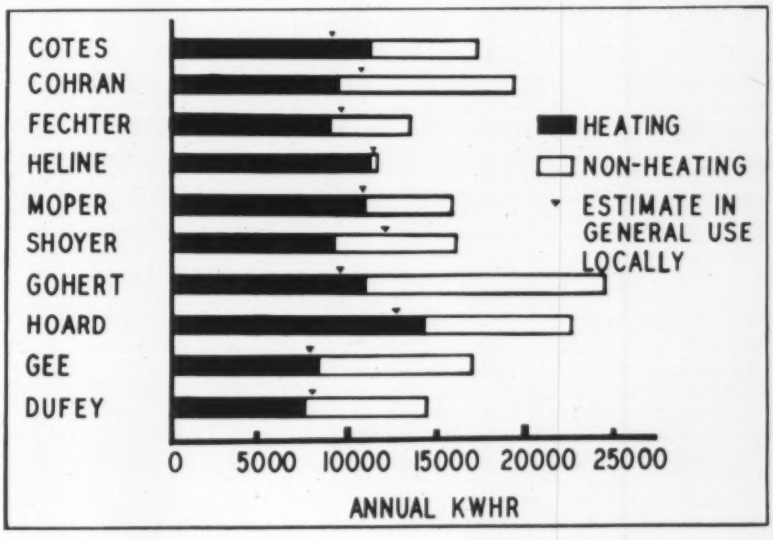



**Fig. 3 — Diagram of data taken from last 4 columns of Table 2 (10 Indiana homes)**

Table A-2 in the Appendix gives a statistical record of average total electrical energy for all uses in the electrically heated homes of one utility for 3 years. Through the first year, the same houses were analyzed; in subsequent years, the average of all homes for each month was analyzed. This demonstrates the month by month increase in electrically heated homes on this utility's lines.

In commercial installations, experience records demonstrate actual energy required to be far below net requirements calculated for other fuels. Such installations normally have proportionally greater internal heat sources than residences. In one school built to use electric heat, calculated oil consumption, if oil had been used, ranged from 14,689 gal to 16,015 gal; converting the anticipated net heat delivered to equivalent kwhr of electricity would indicate from 424,789 to 463,135 kwhr of electricity to be required. The first year of operation required 133,480 kwhr to heat the

school. The second year was complicated by construction of an additional 4 classrooms, multi-purpose room and kitchen, more than doubling the electrical connected load. The period from September 1956 through January 1957 was relatively free from influence of the addition, with 69,360 kwhr required for heating, representing 55.8 percent of the normal heating season degree-days. Projecting this partial operation to the equivalent of a full season would indicate about 125,000 kwhr to be required for heating this school. This application, running less than one-third the energy requirement conventionally calculated, is affected by close control of the heating during relatively short hours scheduled for heating.[5,6]

The store and offices of a lumber company contain 36,000 cu ft with a calculated heat loss of 148,381 Btuh. Based on 70 deg temperature difference, 37.3 deg average temperature and 6,363 degree-days, the calculated energy requirement would be 103,333 kwhr. The estimate on which electric heat was sold assumed 59,752 kwhr to heat. The actual sub-metered energy required to heat it was 19,720 kwhr for the 1955-1956 heating season, which had 6,192 degree-days. It is of interest to note that the non-heating use was 109,380 kwhr and the total use was 129,100 kwhr.[7]

Acceptance of the following statements as facts logically precedes the conclusions:

1. Efficiency of conversion of electricity to heat with resistance electric heating equipment is 100 percent.
2. Efficiency of utilization of electric heat is high when heaters are located within the space they serve.
3. Internal sources of heat and sun effect contribute materially to satisfying heating requirements in well insulated buildings, regardless of the heating system used.

## Conclusions

**1. Use of formulas developed for combustion heating fuel requirements give abnormally high energy requirements for heating with electricity. The reasons for these deviations of actual from calculated values should be investigated.**

**2. There is need for authentic and realistic evaluation of practical methods for predicting energy requirements for heating with electricity.**

## References

1. Table 213, Gas Facts, 1957 (*American Gas Association*, New York, N. Y.).
2. Serving the All-Electric Home, by William R. New and William A. Bell, Jr. (*Electrical World*), March 19, 1956, p. 124.
3. *NEMA* Manual for Electric House Heating, (*National Electrical Manufacturers' Association*, New York, N. Y., *NEMA* pub. No. HE-1-1957, *AIA* File No. 30-C-44).
4. Heating Value: Electricity and Combustible Fuels, by W. J. Novak (*Electrical Construction and Maintenance*, April 1957, p. 96).
5. Heat Schools Electrically?, by Robert Lee Boyd (*Heating, Piping & Air Conditioning*, December 1956, p. 86).
6. It's Here . . . The All-Electric School, by Robert Lee Boyd (*Electrical Construction and Maintenance* February 1957, p. 80).
7. Case History for Electric Heating (*Electric Heat and Air Conditioning*, May-June 1957, p. 20).

## APPENDIX

Table A-2 shows the experience record of average total kwhr billed to all electric home heating customers of the Indiana and Michigan Electric Co. for heating and general use, for the periods shown. While no accurate record was kept of the size of the homes, it is estimated the average is about 1150 to 1200 sq ft floor area, which average has been maintained in the region for several years.

**Table A-1 — Additonal details on table 2 residences**

| Description | Cotes | Cottrell | Fechter | Heline | Moper | Shoyer | Gobert | Hoard | Gee | Dufey |
|---|---|---|---|---|---|---|---|---|---|---|
| Type system | BB | BB | BB & C | BB | Cable | BB | Cable | Cable | BB | BB |
| No. rooms | 6 | 7 | 6 | 7 | 6 | 8 | 6 | — | 5 | 5 |
| Installed kw | 9.85 | 16.9 | 10.1 | 8.75 | 9.8 | 17.25 | 11.4 | — | 8.7 | 8.7 |
| TOTAL ENERGY | | | | | | | | | | |
| Jan. | 2788 | 2368 | 492 | 2192 | 2354 | 2126 | 3830 | 3600 | 2630 | 2260 |
| Feb. | 2262 | 2150 | 606 | 1690 | 2090 | 1380 | 3456 | 3250 | 2290 | 2220 |
| Mar. | 1340 | 1800 | 572 | 780 | 1322 | 862 | 2852 | 2970 | 1890 | 1800 |
| Apr. | 618 | 870 | 328 | 178 | 584 | 562 | 2112 | 3120 | 1940 | 1750 |
| May | 584 | 968 | 362 | 130 | 514 | 552 | 1348 | 1300 | 1050 | 870 |
| June | 516 | 860 | 406 | 56 | 500 | 510 | 1068 | 970 | 770 | 550 |
| July | 498 | 756 | 900 | 60 | 450 | 574 | 908 | 640 | 570 | 390 |
| Aug. | 432 | 888 | 1892 | 60 | 382 | 674 | 950 | 670 | 760 | 430 |
| Sept. | 988 | 848 | 2264 | 470 | 524 | 1526 | 1128 | 820 | 610 | 520 |
| Oct. | 1852 | 1802 | 2218 | 1286 | 1606 | 2340 | 1262 | 1060 | 810 | 690 |
| Nov. | 2650 | 2846 | 2172 | 2380 | 2576 | 2480 | 2486 | 1460 | 1270 | 1010 |
| Dec. | 2482 | 3082 | 1644 | 2458 | 2816 | 2136 | 3396 | 2600 | 2140 | 1910 |
| HEAT ENERGY | | | | | | | | | | |
| Jan. | | | | | | | 2450 | 2851 | 1944 | 1680 |
| Feb. | | | | | | | 1976 | 2505 | 1628 | 1550 |
| Mar. | | | | | | | 1618 | 2331 | 1199 | 1192 |
| Apr. | | | | | | | 958 | 2411 | 1198 | 1158 |
| May | | | | | | | 220 | 624 | 367 | 227 |
| June | | | | | | | 76 | 303 | 186 | 85 |
| July | | | | | | | 4 | 10 | 0 | 0 |
| Aug. | | | | | | | 4 | 7 | 0 | 0 |
| Sept. | | | | | | | 42 | 66 | 54 | 30 |
| Oct. | | | | | | | 208 | 344 | 253 | 177 |
| Nov. | | | | | | | 1288 | 734 | 581 | 415 |
| Dec. | | | | | | | 2020 | 1930 | 1471 | 1292 |

**Table A-2 — Statistical experience with electric heat in Indiana**

| Month | Average Experience Record | | | | | |
|---|---|---|---|---|---|---|
| | 1954-1955 | | 1955-1956 | | 1956-1957 | |
| | kwhr | homes[a] | kwhr | homes | kwhr | homes |
| June | 1036 | 1035 | 786 | 1053 | 1054 | 1806 |
| July | 496 | 1035 | 587 | 1101 | 611 | 1852 |
| Aug | 412 | 1035 | 472 | 1147 | 509 | 1909 |
| Sept | 433 | 1035 | 486 | 1216 | 538 | 2033 |
| Oct | 527 | 1035 | 594 | 1268 | 696 | 2093 |
| Nov | 1190 | 1035 | 1514 | 1359 | 932 | 2213 |
| Dec | 2146 | 1035 | 2527 | 1483 | 2060 | 2320 |
| Jan | 2879 | 1035 | 3366 | 1563 | 2948 | 2416 |
| Feb | 3170 | 1035 | 3211 | 1622 | 3434 | 2492 |
| Mar | 3284 | 1035 | 2957 | 1659 | 2908 | 2548 |
| Apr | 2305 | 1035 | 2459 | 1695 | 2470 | 2595 |
| May | 1246 | 1035 | 1860 | 1746 | 1781 | 2663 |
| Total | 19124 | | 20619 | | 19941 | |

[a]Data based on same residences for full year.

# Omni-Directional Low-Speed Hot-Wire Anemometer

By J. F. Kemp*, Pretoria, South Africa

**SUMMARY—A simple and relatively inexpensive hot-wire anemometer for speeds below 600 fpm is described. The velocity sensing element of the anemometer is made in the form of a small, hollow sphere, whose wall is uniformly heated by an electric current. As a result of the symmetric construction and heating of the element, the instrument becomes almost insensitive to flow direction over the full range of yaw and over a fairly wide range of incidence.**

IN VENTILATION studies it is often required to measure flow speeds only, while the actual flow direction is of little or no importance. Study of air speed distribution in a ventilated room may be quoted as a typical example.

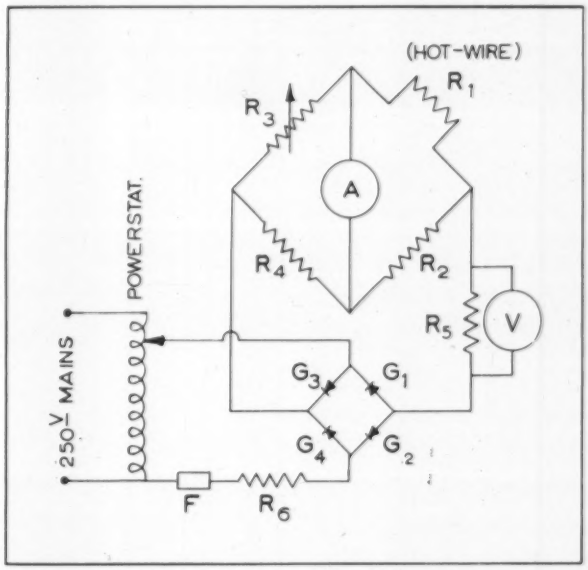
Instruments commonly used in ventilation practice, such as the vane and the hot-wire types of anemometer, are generally not very suitable for measurements of this nature for these instruments are sensitive to flow direction, and their calibration depends on the attitude in which their velocity sensing elements are set up. Thus, even if the flow direction can be determined by means of smoke or tufts, an adjustment of the sensing element to comply with flow direction introduces errors as a result of the sensitiveness of the element to attitude.

Although the hot-wire anemometer described in this paper is not perfectly omni-directional, there is a fairly wide range of flow directions which does not affect its response.

## Basic Considerations

The hot-wire was selected as the basic type of sensing element for the development of an omni-directional instrument because of its high sensitivity at low speeds and of the variety of possibilities presented in its construction.

If heat losses from the element by natural convection are assumed negligible in comparison with the losses due to forced convection, the logical shape of the element for an omni-directional instrument is spherical. An additional requirement is that the heating of this spherical element should be of a symmetric nature, so that, at any given velocity, the same flow pattern and the same temperature distribution will exist over the exposed surface of the element, irrespective of the flow direction.




A = Micro-ammeter 100-0-100 micro-amps.
V = Voltmeter, d-c, 0-20 volts.
F = Fuse, ¾ amp.
R1 = Hot-wire, 30 S.W.G. enamel-coated iron (approximately 4 ohms unheated).
R2 = 400 ohms, wire-wound, constantan.
R3 = 30 S.W.G. constantan wire.
R4 = 100 ohms, wire-wound, constantan.
R5 = 2 ohms, platinum wire, 0.001 in. diam.
R6 = 200 ohms.
G1 — G4 = Metal rectifiers, type Q2B8SG, MS, 1 amp, 200 volt.

**Fig. 1 — Circuit diagram of anemometer**

Unfortunately, heat exchange by natural convection becomes important as the flow speeds decrease. Since the natural convection currents always tend vertically upwards, they may be either assisted or opposed by the main flow, depending on the direction of flow. Natural convection therefore has an adverse effect on the

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For presentation at the 65th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Philadelphia, Pa., January 1959.

otherwise symmetric flow and heat transfer conditions, and consequently on the omni-directional properties of the instrument.

In order to limit the strength of the convection currents it is desirable to operate the heated sphere at a fairly low temperature. Too low a temperature, on the other hand, is disadvantageous to the sensitivity of the anemometer, and also aggravates the effect that ambient temperature variations have on the calibration of the instrument.

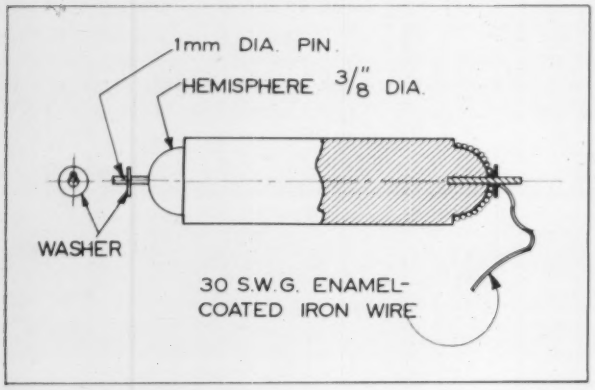


**Fig. 2 — Jig for winding spherical hot-wire element**

### Design and Construction

*Operation*: The constant-resistance method of measurement was adopted for the anemometer. In this method the resistance of the hot-wire element is maintained constant by adjusting the heating current, which serves as a measure of the air speed.

The Callendar system, described by Ower[1], is used. The hot-wire element $R_1$ (30 S.W.G. iron wire) forms part of a Wheatstone bridge (Fig. 1), and has a resistance of 4 ohms when unheated. The other components of the bridge, $R_2$, $R_3$ and $R_4$, are made of constantan wire. $R_2$ and $R_4$ have resistances of 400 and 100 ohms respectively. The effective length of $R_3$ is adjusted to yield balance of the bridge when a current of about 0.13 amps is passed through $R_1$, when $R_1$ is kept in still air.

The combination of $R_5$ and V is termed a volt-thermometer. $R_5$ comprises a 5-in. length of 0.001-in. diameter platinum wire, which is suitably shielded from air disturbances. As a result of the relatively high temperature coefficient of resistivity of platinum (0.003 per C deg between 0 and 100 C), the voltage drop across $R_5$ increases at a much higher rate than the heating current as the wire temperature rises.

From the relative values of the bridge resistors $R_1$, $R_2$, $R_3$ and $R_4$, it is evident that the greater portion of the current through $R_5$ passes through the hot-wire element $R_1$.

Whereas the air speed varies, over a wide range, approximately as the fourth power of the heating current through $R_1$, it varies by some power between 2 and 3 of the voltage drop across $R_5$, by virtue of the heating effect of the platinum wire. Thus, by utilizing the volt-thermometer instead of measuring directly the heating current, an appreciable gain in sensitivity and accuracy is achieved at higher flow speeds.

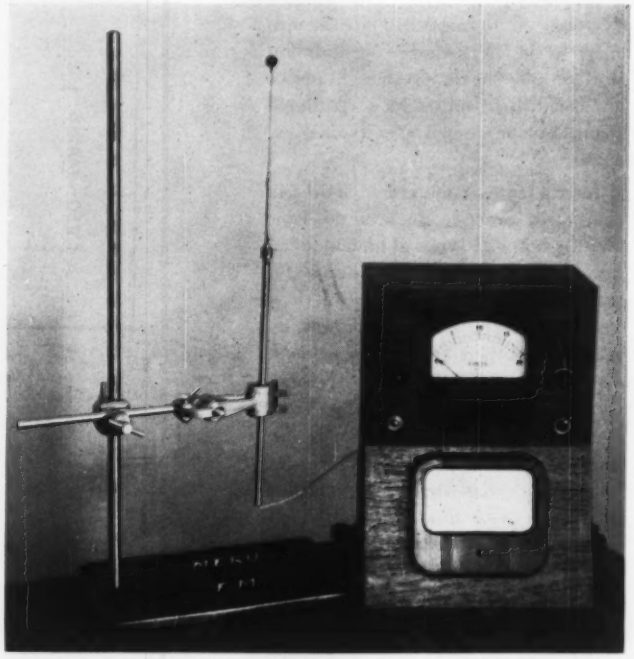

**Fig. 3 — Photograph of anemometer**

A simple rectifier bridge, comprising four 1-amp, 200-volt metal rectifiers, $G_1$, $G_2$, $G_3$, is incorporated to permit a-c operation of the anemom-

[1]Exponent numerals refer to References.

eter. The full-wave rectified current supplied to the Wheatstone bridge, though not filtered, enables either a d-c ammeter or a sensitive galvanometer to be used for balance indication.

A-c power is supplied from the mains via a variable autotransformer (powerstat), which is used to regulate the heating current. By incorporating resistor $R_6$ (nichrome wire, 200 ohms) the powerstat is made to operate in the higher range of its voltage scale, so that current control can be effected more accurately. Fuse F protects the system against overloads.

*Velocity Sensing Element*: The velocity sensing element of the anemometer is made in the form of a 3/8-in. diameter hollow sphere, whose walls consist of a single layer of 30 S.W.G. enamel-coated iron wire ($R_1$ of the system in Fig. 1). The sphere is supported on a 1 mm outer diameter hypodermic steel tube.

Construction of the sphere was carried out by use of the simple jig illustrated in Fig. 2, and required some skill and patience. The sphere was built up in 2 halves, the wire forming the hemispherical cup sections being wound separately on the 2 half-round noses of the jig. After completion of the winding process, a thin layer of glyptal was applied to each cup section in order to obtain a smooth surface. The glyptal was then allowed to dry before removing the cups from the jig.

The sphere was then assembled on its supporting steel tube, first by soldering together the loose ends of

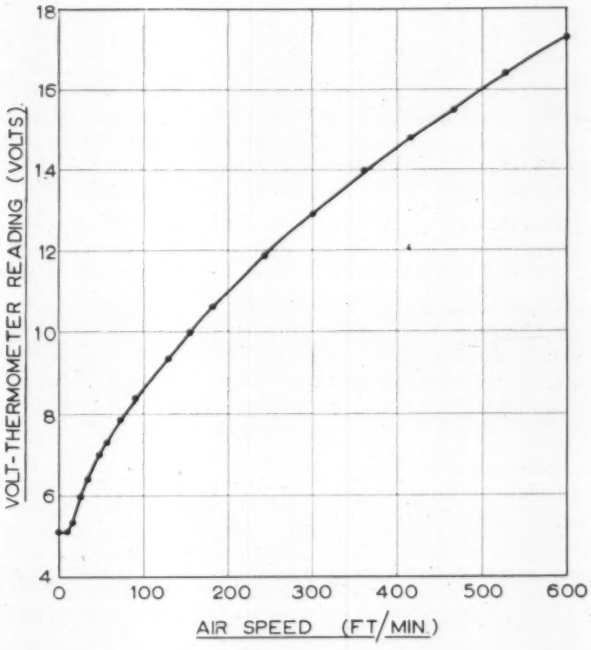


Fig. 4 — Calibration curve of instrument

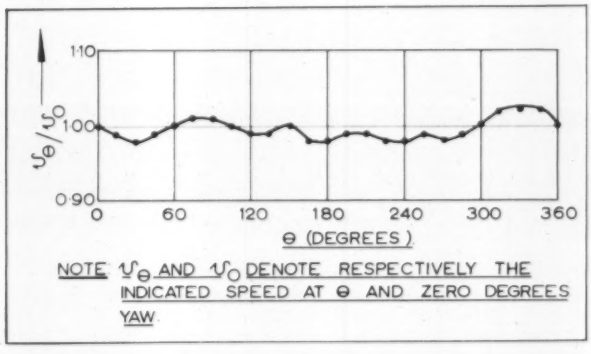


Fig. 5 — Directional response of anemometer in horizontal flow. The symbol v sub Theta in this figure is the same as the symbol $v_t$ in the text

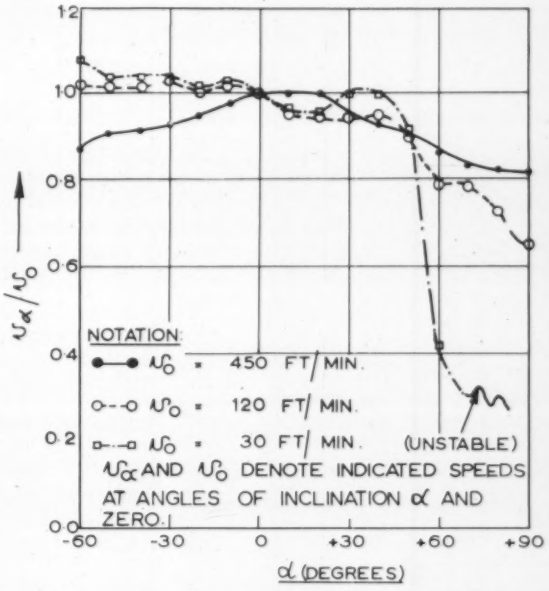


Fig. 6 — Response of anemometer to flow directions in a vertical plane. α is zero for horizontal flow, and positive for downward flow. The symbol v sub Alpha in this figure is the same as the symbol $v_\alpha$ in the text

the wire on the rims of the cups, and finally by applying another layer of glyptal.

One of the leads to the sphere was threaded through the hypodermic tube, while the other was taken along the outside of the tube before entering the hollow stem of the instrument farther down. Some of the constructional features may be studied from the photograph in Fig. 3, which shows the completed instrument.

Prior to calibrating the anemometer, the glyptal on the sphere was baked hard and dry, by passing an electric current through the element for about an hour.

### Calibration and Performance

The anemometer was carefully calibrated between 0 and 600 fpm against a low speed indicator[2] in a 24-in. wind-tunnel, the stem support of the hot-wire element being set up in a vertical attitude. The calibration curve is depicted in Fig. 4.

The air speed in the tunnel was then set to a convenient value of about 450 fpm and the response of the anemometer to yaw investigated every 15 deg from 0 to 360. The results of this test are presented in Fig. 5 where the ratio $v_t/v_o$ is plotted against G(or $t$), the angle of yaw ($v_t$ and $v_o$ denote respectively the indicated speeds at $t$ and at zero degrees).

The maximum deviation of $v_t/v_o$ from the value 1.00 at G(or $t$) = 0, is $\pm 2$ percent. It may, therefore, be concluded that the instrument is 98 percent insensitive to the direction of flow in a horizontal plane.

Finally, the directional response of the anemometer was investigated for variations of the air velocity in a vertical plane. For this purpose a simple test rig was constructed. A small centrifugal fan was used to force air through a perspex pipe, 4 ft long and 6 in. in diameter, gauze screens being provided to improve the flow quality in the pipe. The spherical element of the anemometer was set up centrally in the free jet near the pipe outlet. The rig was supported in such a way that it could be inclined to any desired position in a vertical plane, while the relative position between the spherical element of the anemometer and the pipe outlet remained unchanged.

The response of the anemometer was determined at three constant flow speeds, *viz.*, at 450, 120 and 30 fpm, the angle of inclination $\alpha$ being varied, at 10 deg intervals, from $-60$ deg through 0 deg to $+90$ deg ($\alpha$ is taken as zero for horizontal flow, and as $+90$ deg for vertical flow downwards).

The relationship between $v_a/v_o$ and $\alpha$ (or a) is plotted in Fig. 6.

The graph illustrates how the directional response characteristics of the anemometer deteriorate with decreasing speed in the region 50 deg $< \alpha$ (or a) $< 90$ deg. At 30 fpm the natural convection currents appear to have approximately the same strength as the main flow. When the flow is directed downwards, the convection currents are forced back towards the sphere, thereby restricting the rate of heat escape.

At higher speeds this effect is less marked, as forced convection gradually becomes the predominating influence whereby heat exchange takes place between sphere and air current.

The set of curves in Fig. 6 indicates that the anemometer is approximately 90 percent insensitive to flow direction in the range $-50$ deg $< \alpha$ (or a) $< +50$ deg.

Apart from its omni-directional properties, other noteworthy features of the instrument are its simplicity of construction and operation, the small dimensions of its velocity sensing element, and a fairly quick reaction time of less than one minute.

### Acknowledgments

The work described was performed in the *National Mechanical Engineering Research Institute* and is published by permission of the *South African Council for Scientific and Industrial Research*. The author wishes to thank B. van Wamelen and M. L. Strydom for valuable assistance during the development of the instrument.

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2. A Sensitive Aerodynamic Drag Balance as an Indicator of Low Air Speeds, by J. F. Kemp (*Journal of Scientific Instruments*, Vol. 34, October 1957, pp. 411-415).

**ASHAE**
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**65th Annual Meeting, January 26-29, 1959**

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from the RESEARCH LABORATORY

*This paper is the result of research carried out by the*
AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS
at its Research Laboratory located at 7218 Euclid Avenue, Cleveland 3, Ohio

# Heat Gain Through Windows Shaded by Metal Awnings

By Necati Ozisik* and L. F. Schutrum,** Cleveland, Ohio

**SUMMARY: The heat gain through glass windows shaded by metal awnings was experimentally investigated by testing 5 awnings of conventional types and colors. The test data for the transmitted and convected-radiated components of the heat gain correlated well with the calculated values.**

**Design data are presented for the awnings tested for east, south and west orientations and for various hours of the day from 7 a.m. to 5 p.m. sun time for 40 deg North Latitude and a clear atmosphere, on August 1.**

**Over that period of a day during which an awning prevents the direct sun from falling upon the glass surface, the amount of solar heat excluded by the awning is 70 to 75 percent on a western exposure and 50 to 60 percent on a southern exposure, and 75 to 80 percent on an eastern exposure.**

THIS paper, which presents data on the effectiveness of metal awnings in reducing the transmission of solar heat through glass windows, is the result of research carried out at the ASHAE Research Laboratory under the guidance of the TAC on Heat Transfer through Fenestration†. An earlier paper presented the results of similar research on canvas awnings.

The awnings tested were selected at a meeting attended by the representatives of the metal awning industry, members of the TAC, and members of the ASHAE Research Laboratory staff. In making selections, the outside color, shape and venting characteristics of the awnings were recognized as significant factors influencing the heat gain. Because they provided a means of evaluating these factors and because they were considered typical of the more widely used types of metal awnings, the following were selected for testing:

1. Pan and cover type, sides closed, inside white, outside white.
2. Pan and cover type, sides closed, inside white, outside dark green.
3. Solid pan type, sides closed, inside white, outside white.
4. Horizontal louver type, sides open, inside white, outside white.
5. Horizontal retractable type††, sides closed, inside white, outside white.

White and dark green were chosen as the most commonly used colors to illustrate the effect of color. The solid pan type awning with closed ends was considered as representative of the type which afforded little or no venting, whereas the *louver* and *pan and cover* types permitted ample venting.

The size and shape of the test awnings are given in Fig. 1. The solar reflectance (normal) of the awning material, as obtained from measurements made at the Laboratory using a pyrheliometer, and comparing it with a sample of known reflectance, was 0.30 for the dark green surface and 0.70 for white.

## Test Apparatus

The heat gain was measured by means of the solar calorimeter essentially as described in references 1 and 2. The window of the calorimeter was 44¼ in. square, and consisted of ¼-in. thick regular plate glass.‡ The window had no setback. A general view of the calorimeter with the metal awning in position is shown in Fig. 2.

Measurements of direct, diffuse and ground reflected solar radiation were made with 3 Eppley thermoelectric type pyrheliometers. All temperatures were measured by copper-constantan thermocouples. Two 16-point electronic recorders provided continuous readings throughout the tests. Tests were made either with the calorimeter following the sun or for a fixed orientation.

The foreground immediately in front of the calorimeter was a dark-colored platform surrounded by a grass lawn.

*Heat Gain through Glass and Shade Combination*: An analytical

*Research Engineer, ASHAE Research Laboratory.

**Research Supervisor, ASHAE Research Laboratory. Member of ASHAE.

†Personnel: R. W. McKinley, *chairman*; R. C. Jordan, *vice chairman*; W. J. Arner, T. C. Carson, E. W. Conover, R. B. Crepps, W. B. Ewing, J. E. Frazier, H. F. Kingsbury, J. B. Leavy, Manny Levine, E. C. Miles, Bruno Morabito, F. W. Mowrey, D. J. Vild, H. B. Vincent, O. F. Wenzler, C. J. Youngblood, jr.

For presentation at the 65th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Philadelphia, Pa., January 1959.

††Test was made only for spot-checking purposes.

‡Transmittance for direct solar radiation (normal) 0.77.

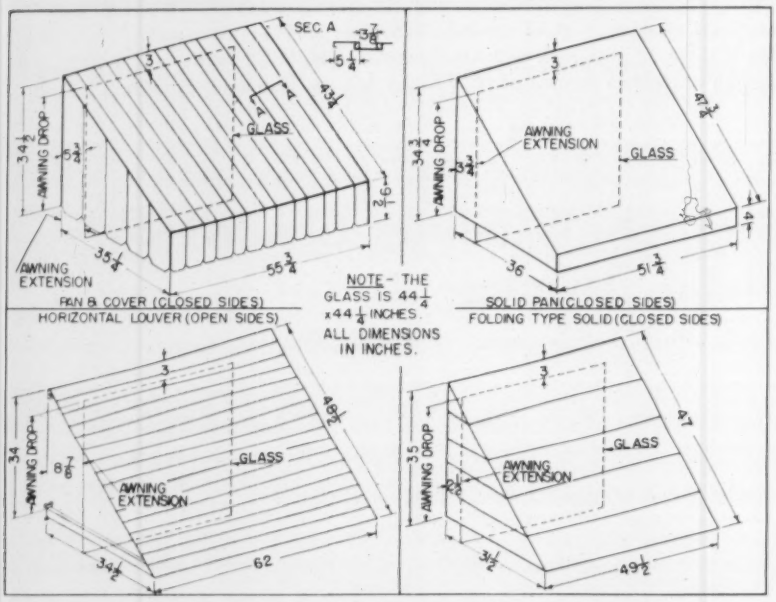
SEC A
GLASS
AWNING DROP
AWNING EXTENSION
PAN & COVER (CLOSED SIDES)
HORIZONTAL LOUVER (OPEN SIDES)
NOTE - THE GLASS IS 44 1/4 x 44 1/4 INCHES.
ALL DIMENSIONS IN INCHES.
SOLID PAN (CLOSED SIDES)
FOLDING TYPE SOLID (CLOSED SIDES)

**Fig. 1—Shape and size of metal awnings tested**

**Fig. 2—View of the solar calorimeter**

treatment for the heat gain through a window shaded by an awning was given in an earlier paper[1], and the same analysis was used in correlating the test data on metal awnings.

In the presence of solar radiation, the heat gain through a window is the sum of transmitted and convected-radiated gains. As explained in Reference 1, the fraction of solar radiation which passes directly through the glass is referred to as the transmitted heat gain; the heat dissipation from the warm glass into the room is known as the convection-radiation heat gain.

The test data for the transmitted component of the heat gain were correlated as a function of the dimensionless ratio $(I_{GV}/I_{dV})$, where $I_{GV}$ and $I_{dV}$ are respectively the intensity of ground reflected and total diffuse solar radiation falling upon a vertical wall having the same orientation as the window. Fig. 3 shows the transmittance□ for the awning-glass combinations as a function of $(I_{GV}/I_{dV})$ for the pan and cover, solid pan and horizontal louver (sides open) type awnings. The solid lines in this figure are the calculated values based on the analysis given in Appendix A[1].

Design data on the transmitted component of the total heat gain for the awning-glass combinations tested were calculated utilizing the relations given in Fig. 3. For the calculations, the solar radiation intensities were taken from ASHAE GUIDE for a clear atmosphere at 40 deg north latitude on August 1; and the ratio $(I_{GV}/I_{dV})$ for each condition was determined as explained in Appendix B[1]. These data are tabulated in Table 1A for east, south and west orientations and for various hours of the day.

The test data for the convection-radiation heat gains from the glass into the calorimeter, after being adjusted to a 75 F indoor temperature, are in good agreement with the calculated curve as shown in Fig. 4. (The calculated curve was obtained by the same treatment as that given in Appendix C, Reference 1.) As will be seen from this figure, the convection-radiation heat gain is a function of a term which is the sum of the outdoor air temperature $(t_o)$, one-third the solar heat absorbed per unit area of the glass $(\alpha I_g)$*, and a fraction (determined experimentally) of the solar heat absorbed per unit area of the awning $(\alpha I_a)$*. For wind veloci-

[1]Exponent numerals refer to References.

□Solar energy transmitted per unit area of the glass surface divided by the intensity of the total diffuse solar radiation falling on a vertical wall having the same orientation as the window.

*$\alpha I_a$, $\alpha I_g$ = solar energy absorbed by the awning and glass, respectively, Btu per(hour) (square foot).

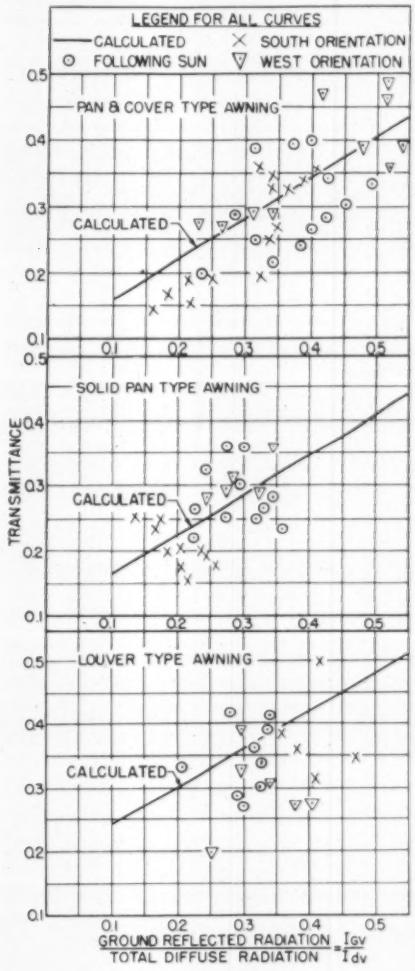


**Fig. 3 *(left)* — Transmittance of metal awnings with regular plate glass**

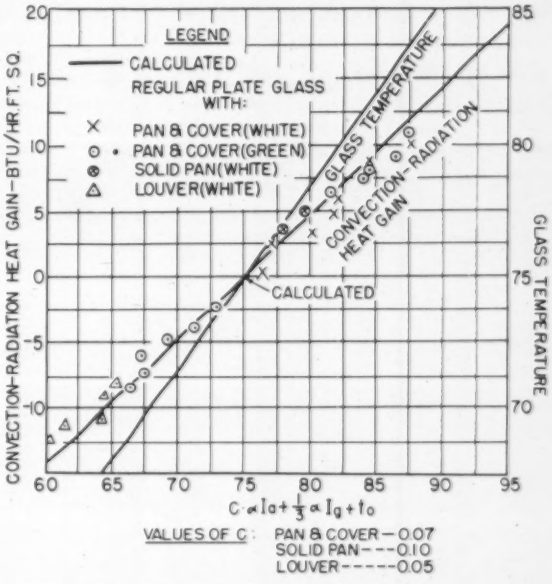


**Fig. 4 *(above)* — Convection-radiation heat gain and glass temperature (for 75 F indoor temperature)**

ties up to 5 mph, this fraction was approximately 0.10 for the solid pan-type awning, 0.07 for the pan- and cover-type awning, and 0.05 for the louver-type awning. For wind velocities above 5 mph, it was approximately 0.05 for all of the awnings tested.

The design data for the convection-radiation heat gains were calculated using the values from the curve in Fig. 4. Calculations were based on the same solar radiation intensities used in calculating the transmitted component. These data were tabulated in Table 1B for east, south and west orientations and for various hours of the day.

The total heat gain through a window shaded by an awning is the sum of the transmitted and convected-radiated heat gains. The total gains for the awnings tested are given in Table 1C. These values are the sums of the components given in Tables 1A and 1B.

## Application of Data

The data presented in Table 1 are strictly applicable only to the 44¼-in.-square regular plate glass test window in combination with the awnings tested, and facing a dark colored foreground. However, by making corrections described hereafter, the data in Table 1 may be applied to other size window-awning combinations and types of glass.

All the awnings tested had drops†† of approximately 70 percent. Provided that the awning drop remains the same, the variation in the width of window, within reasonable limits, does not appreciably alter the total heat gain given in Table 1C. If the awning drop is less than 70 percent, there may be additional sunlit glass areas in the lower section** of the glass which have not been accounted for in Table 1C. For awning drops other than 70 percent, the additional sunlit area, if any, in the lower section can be estimated from Table 2. Although this table is for a 3-ft × 5-ft window, it may be applied to windows of other dimensions without serious error. The heat gain through the additional sunlit area can be obtained from Table 1D.

The data in Table 1 are for a regular plate glass, but it can be applied

††Awning drop is defined as the fraction of the height of the window covered by the awning, see Fig. 2.

**Total glass height minus 1.4 times awning drop in feet.

with only a small error to awnings in combination with ordinary window glass or heat absorbing glass. The data in Table 1C are a few Btu low for the ordinary window glass and high for the heat absorbing glass.

The data in Table 1B and 1C are for an inside temperature of 75 F and for outside temperatures as indicated in Table 1 for different hours of the day. For temperature differentials other than those used in this table, the data may be corrected by adding or subtracting 1 Btu per (hr) (sq ft) for each degree of variation in temperature differential.

The data in Table 1C are for a dark foreground. For a light colored foreground, the values given in Table 1C should be increased by an amount approximately equal to the transmitted component of heat gain given in Table 1A (see Reference 1.)

Therefore, heat gain through any glass-awning combination having less than 70 percent drop for temperature differentials other than those on which Table 1C values are based and for a light colored foreground, can be determined in the following manner:

1. Heat gain through sunlit glass area in the lower section of the window is equal to the sunlit area from Table 2, multiplied by the appropriate value from Table 1D.

2. Heat gain through the remaining area of the glass is equal to the area of the remainder multiplied by the appropriate value from Table 1C.

3. For temperature differentials other than those on which Table 1C is based, data should be corrected by adding or subtracting an amount equal to the entire glass area multiplied by 1 Btu per hour for each degree of variation in temperature differential.

4. For a light colored foreground, increase in the heat gain is approximately equal to the entire glass area multiplied by the appropriate value from Table 1A.

*Example*: *A southerly-oriented window having an ordinary window glass 3 ft wide and 5 ft high is shaded by a solid pan (sides closed) type white metal awning. The drop of the awning covers only 55 percent of the glass height. Calculate the total heat gain through the window at 3 p.m. for*: 1. *75 F indoor temperature and a dark foreground*; 2. *80 F indoor temperature and a dark foreground*; 3. *80 F indoor temperature and a light colored foreground.*

*Solution*: As the drop of the awning covers less than 70 percent of the entire glass height, the amount of sunlit area at the lower section of the glass should be determined. From Table 2, the sunlit area at 3:00 p.m. for solid pan type awning with 55 percent drop is about 7 percent of the entire glass surface. Therefore, the sunlit area = 3 × 5 × 0.07 = 1 sq ft (approx.) and the shaded area = 3 × 5 − 1 = 14 sq ft.

1. Total heat gain for a 75 F indoor temperature and a dark foreground: For the shaded area (from Table 1C, column 3): 14 × 34 = 476 Btu per hr; For the sunlit area (from Table 1D, column 2): 1 × 63 = 63 Btu per hr; Total heat gain through the entire glass surface: 539 Btu per hr.

2. Total heat gain for an 80 F indoor temperature and dark foreground: The air temperature differential for this example is 95 − 80 = 15 F, whereas Table 1C value for 3 p.m. south is based on 95 − 75 = 20 F. Allowing 1 Btu per (hr) (sq ft) correction per Fahrenheit deg difference in temperature differential, the reduction in heat gain is 15 × 5 = 75 Btu per hr. Hence, the total heat gain is 539 − 75 = 464 Btu per hr.

3. Total heat gain for an 80 F indoor temperature and a light colored foreground: The additional heat gain due to the increase in the transmitted component of the heat gain (from Table 1A, column 2) is 9 Btu per (hr) (sq ft). Hence, the total heat gain is 464 + 9 × 15 = 599 Btu per hr.

**Table 1—Design data on heat gains through metal awning-glass combination for 75 F indoor temperature**

| Orientation | Sun Time | Outdoor Temp. F | Table - 1A Transmitted | | | Table - 1B Heat Gains[a] With Awnings Convection—Radiation | | | | | Table - 1C Total Gain | | | | | Table - 1D Total Heat Gain[a] Glass Only Type of Glass | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pan & Cover | Solid Pan | Louver | Pan & Cover White | Pan & Cover Green | Solid Pan White | Solid Pan Green | Louver White | Pan & Cover White | Pan & Cover Green | Solid Pan White | Solid Pan Green | Louver White | Reg. Plate (b) | Ord. Window (c) | Heat Absor. (d) |
| EAST | 7AM | 75 | 8+8[e] | 7+8[e] | 10 | 4 | 8 | 4 | 10 | 4 | 20 | 24 | 19 | 25 | 14 | 183 | 199 | 135 |
| | 8 | 77 | 10 | 9 | 12 | 6 | 11 | 8 | 14 | 6 | 16 | 21 | 17 | 23 | 18 | 192 | 211 | 142 |
| | 9 | 80 | 13 | 11 | 14 | 10 | 15 | 11 | 19 | 9 | 23 | 28 | 22 | 30 | 23 | 172 | 187 | 129 |
| | 10 | 83 | 13 | 11 | 14 | 12 | 19 | 14 | 22 | 12 | 25 | 32 | 25 | 33 | 26 | 124 | 137 | 94 |
| | 11 | 87 | 14 | 12 | 14 | 16 | 22 | 18 | 26 | 16 | 30 | 36 | 30 | 38 | 30 | 67 | 71 | 54 |
| | 12 | 90 | 13 | 11 | 12 | 18 | 24 | 20 | 26 | 18 | 31 | 37 | 31 | 37 | 30 | 32 | 33 | 27 |
| SOUTH | 8 | 77 | 8+1[e] | 7 | 8+ 5[e] | 5 | 8 | 6 | 10 | 4 | 14 | 17 | 13 | 17 | 17 | 19 | 20 | 14 |
| | 9 | 80 | 11 | 9 | 11+10[e] | 8 | 13 | 10 | 16 | 8 | 19 | 24 | 19 | 25 | 29 | 44 | 48 | 34 |
| | 10 | 83 | 12 | 11 | 12+ 8[e] | 11 | 18 | 14 | 21 | 12 | 23 | 30 | 25 | 32 | 32 | 73 | 78 | 57 |
| | 11 | 87 | 14 | 12 | 14 | 16 | 22 | 18 | 26 | 16 | 30 | 36 | 30 | 38 | 30 | 96 | 104 | 75 |
| | 12 | 90 | 14 | 13 | 15 | 20 | 26 | 22 | 30 | 20 | 34 | 40 | 35 | 43 | 35 | 107 | 115 | 84 |
| | 1PM | 93 | 14 | 12 | 14 | 23 | 28 | 25 | 34 | 23 | 37 | 42 | 37 | 46 | 37 | 103 | 110 | 82 |
| | 2 | 94 | 12 | 11 | 12+ 8[e] | 24 | 30 | 25 | 33 | 24 | 36 | 42 | 36 | 44 | 44 | 85 | 90 | 69 |
| | 3 | 95 | 11 | 9 | 11+10[e] | 24 | 29 | 25 | 33 | 24 | 35 | 40 | 34 | 42 | 45 | 59 | 63 | 50 |
| | 4 | 94 | 8+1[e] | 7 | 8+ 5[e] | 22 | 26 | 23 | 28 | 21 | 31 | 35 | 30 | 35 | 34 | 36 | 37 | 32 |
| WEST | 12 | 90 | 13 | 11 | 12 | 18 | 24 | 20 | 26 | 18 | 31 | 37 | 31 | 37 | 30 | 32 | 33 | 27 |
| | 1PM | 93 | 14 | 12 | 14 | 23 | 28 | 24 | 33 | 23 | 37 | 42 | 36 | 45 | 37 | 73 | 77 | 61 |
| | 2 | 94 | 13 | 11 | 14 | 24 | 31 | 26 | 35 | 24 | 37 | 44 | 37 | 46 | 38 | 136 | 147 | 107 |
| | 3 | 95 | 13 | 11 | 14 | 25 | 32 | 27 | 36 | 25 | 38 | 45 | 38 | 47 | 39 | 189 | 204 | 148 |
| | 4 | 94 | 10 | 9 | 12 | 24 | 30 | 25 | 33 | 24 | 34 | 40 | 34 | 42 | 36 | 210 | 228 | 164 |
| | 5 | 93 | 8+8[e] | 7+8[e] | 10 | 22 | 26 | 23 | 29 | 22 | 38 | 42 | 38 | 44 | 32 | 202 | 217 | 157 |

*Note*: Data obtained from a 44 in. square regular plate glass window facing a dark foreground and shaded by an awning having a drop of 70 percent. Values are calculated for a combined outside conductance of 3 Btu per (hr) (sq ft) (F deg).

[a] All heat gains are in Btu per (hour) (square foot).

[b] Regular plate glass, transmittance for direct-solar radiation (normal) 0.77.

[c] Ordinary window glass, transmittance for direct-solar radiation (normal) 0.87.

[d] Heat absorbing glass, transmittance for direct-solar radiation (normal) 0.41.

[e] Addition due to direct sun on the glass.

## Discussion of Results

The above data on heat gain through metal awning and glass combinations are almost the same as the results obtained previously (Refer-

ence 1) with canvas awnings. The transmitted component of the heat gain differs only by a few Btu for the two types. The difference is largely due to the variation in the size of awning openings, and the difference in the reflectance to solar radiation of the underside of the awnings.

The observed convection-radiation heat gain for metal awning and glass remain about the same as the outdoor air temperature. The convection-radiation heat gain with a white awning is less than that with a vented awning having a high solar-absorbing outer surface. For a white awning venting is not important.

Table 3 was prepared to illustrate the effectiveness of the metal awnings tested in excluding solar heat over

**Table 2—Sunlit area at lower-section of the glass as percentage of the entire glass surface**

| Orientation | Sun Time | | Louver Type (Open Sides) Awning Drop 0.65 | Louver Type (Open Sides) Awning Drop 0.60 | Louver Type (Open Sides) Awning Drop 0.55 | Pan & Cover and Solid Pan Types (Closed Sides) Awning Drop 0.65 | Pan & Cover and Solid Pan Types (Closed Sides) Awning Drop 0.60 | Pan & Cover and Solid Pan Types (Closed Sides) Awning Drop 0.55 |
|---|---|---|---|---|---|---|---|---|
| SOUTH | 7 a.m. | 5 ↑ | — | — | — | — | — | — |
| | 8 | 4 ↑ | 7 | 14 | 22 | 4 | 8 | 13 |
| | 9 ↓ | 3 | 7 | 14 | 21 | 2 | 4 | 7 |
| | 10 | 2 p.m. | 3 | 7 | 10 | — | 2 | 5 |
| EAST ↓ WEST ↑ | 7 a.m. | 5 ↑ | 7 | 14 | 20 | 7 | 13 | 22 |
| | 8 ↓ | 4 | — | — | 4 | — | 7 | 15 |
| | 9 | 3 p.m. | — | — | — | — | — | — |

*Note:* Based on 3ft x 5 ft window, awning extension 5 in. & 10 in. for conventional & louver type awnings respectively.

combinations correlates satisfactorily with the calculated curve shown in Fig. 4. It is interesting to note that the calculated curve for metal awnings is exactly the same as that shown in the previous paper for canvas awnings.

A metal awning having a high solar-absorbing surface on the outside, absorbs much solar radiation, which in turn increases the temperature of the awning, the temperature of air under the awning, and the convection-radiation heat gain into the room. Venting of such an awning tends to reduce the temperature of hot air under the awning, resulting in a little reduction in the convection-radiation heat gain. But with an awning having a low solar absorbing surface on the outside (*i.e.*, white), the awning temperature and the temperature of air under the awning that period of a day during which the awnings stop the direct sun from falling upon the glass. (The data for this table are taken from Tables IC and ID.) This table gives the fraction of solar heat excluded by the awning for east, south and west exposures. The comparison of the results in this table shows that an awning with white color on the outside is more effective in excluding the solar heat.

## Conclusions

**1. The amount of solar heat excluded by a metal awning depends on the type and color of the awning, orientation of the window, and the time of the day. From the data presented in Tables 1A, B, C, D, and Table 2, the heat gain through a glass window shaded by a metal awning can be obtained for east, south and west exposures and for various hours of the day.**

**2. Over that period of a day during which an awning prevents the direct sun from falling upon the glass surface, the amount of solar heat excluded by the awning is 70 to 75 percent on a western exposure, 75 to 80 percent on an eastern exposure, and 50 to 60 percent on a southern exposure.**

**3. An awning having white color on the outside excludes more solar heat than the dark green one. Furthermore, venting of a white awning is not important.**

**Table 3—Heat exclusion by awnings tested**

| Type of Awning | Solar Heat Excluded by the Awning (Percentage) East[a] Orientation | South[b] Orientation | West[c] Orientation |
|---|---|---|---|
| Pan & Cover, outside white | 81 | 58 | 75 |
| Pan & Cover, outside dark green | 77 | 51 | 70 |
| Solid Pan, outside white | 81 | 58 | 75 |
| Solid Pan, outside dark green | 76 | 48 | 69 |
| Louver (sides open), outside white | 81 | 51 | 75 |

[a] From 7 a.m. to 12 noon.
[b] From 8 a.m. to 4 p.m.
[c] From 12 noon to 5 p.m.

## Acknowledgment

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• Plan now on Philadelphia in January 1959 •

# How Research Can Improve Performance of Fibrous and Reflective Insulation

By

**William Turbeville**

The author is manager, Industrial Foil Sales, Aluminum Company of America, Pittsburgh, Pa. A presentation at the Symposium on Thermal Insulation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 24, 1958.

THOSE who believe the old sayings that *ignorance is bliss*, and *what you don't know can't hurt you*, will find nothing of interest in this paper. According to these adages, the best buildings might be designed and constructed by ignorant men. But experience proves the opposite to be true.

Designers, architects, builders and building owners alike must keep informed of new products, new ideas, new technology, or else their structures will be out of date before they are completed. In fact, in design and construction many new buildings are 10 to 15 years behind current information released by research men specializing in building problems.

Probably the main reason for this lag in the use of new knowledge is that so many people feel too busy to read these technical reports that normally have a relatively small circulation. At least this is true in the field of building insulation practice.

## Building Industry Trends Create Need for Better Insulation

Modern trends in home design, using newly developed materials and novel methods of assembly, have created numerous problems in the field of thermal insulation and water vapor migration through walls, floors and ceilings. *U*-factors, vapor barriers, dew-point temperatures and similar terms, which had little significance within the building industry a few years ago, have now become essential considerations for designers and builders. With the increasing acceptance of equipment designed to provide summer cooling in addition to winter heating, the importance of thermal insulation must be impressed upon all engaged in the building industry.

## Research Increases Knowledge

One reason for the great increase in the use of insulating materials has been the research carried on since World War II. Because of this, the building industry understands far more about insulation than was true even 5 years ago. This has resulted in a period of intense, practical experience at the building level.

*First*, there is a growing awareness that there are wide differences in the performance characteristics of various kinds of insulation. Some types perform one function, other types perform other functions. For each specific purpose, one type of insulation or a combination of materials may serve better than others. Actual performance is the final criterion. While most everyone engaged in the industry agrees that a little insulation is good, research and engineering have shown that the more insulation used, the better—and incidentally, the more economical it will be. Research has shown that it is important to choose insulation wisely and use it adequately.

*Second*, research has helped to bring about a greater understanding of the key role radiation plays in selecting the most effective type of insulation. Both the direction of heat flow and the reflectivity of surfaces become significant in the choice of insulation materials.

## How Heat Moves Through Building Materials

Because human bodies are comfortable within only a narrow range of climatic conditions, buildings must be planned to help rectify the excess heat in summer and the heat deficiency in winter. Heat barriers must be set up in the shells of buildings. These barriers must act to retain the heat generated within the buildings in winter (using fuels constantly increasing in cost), and to keep out the excessive heat which the sun delivers in summer.

To understand how these barriers do this job, it is first necessary to understand how heat moves, and this understanding is so basic that a short statement seems in order here.

Heat passes through all building materials to some extent when there is a difference in temperature between the bounding surfaces. The purpose of all insulation is to retard this heat flow. The effectiveness of insulation varies in degree with the material used, the amount used, and the efficiency of insulation.

Heat can travel to and through building materials in only three ways, *viz*: (*a*) by convection, (*b*) by conduction, and (*c*) by radiation. Figs. 1, 2, and 3 respectively illustrate those three processes in a simplified diagrammatic fashion. Fig. 1 aims to make clear that the *convection* flow of heat is by air currents from a warmer to a cooler surface. Similarly, Fig. 2 recalls to mind that *conduction* flow is through matter as a result of molecular

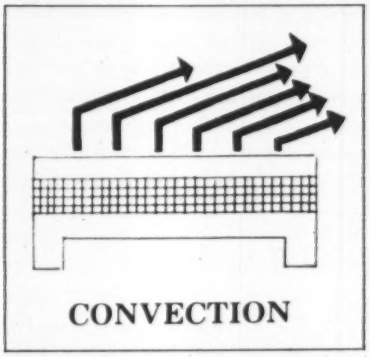


Fig. 1 — Diagrammatic representation of heat movement by convection

Fig. 2 — Illustration of how heat moves through materials by conduction

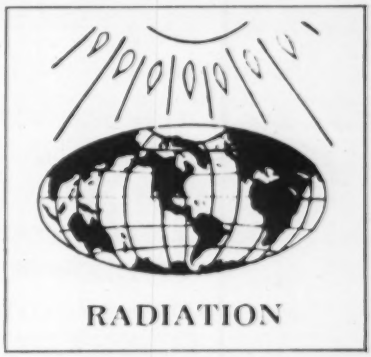


Fig. 3 — Representation of the way heat moves by radiation

contact or transfer. Fig. 3 shows that with *radiation* heat is transmitted across space by invisible rays and by infra-red, or heat, waves. As an example, when the sun warms the skin or an open fire warms one's hands, it is doing so by radiant heat.

One fact about heat travel is seldom realized. It is that still air, whether trapped in the small cells of mass-type insulation, retained in a space adjacent to reflective type insulation, or as a film on any surface, serves as one of the main retardants to thermal flow. Continuous air spaces created between structural elements are very effective as heat barriers and are always considered in calculating the thermal resistance of building components. Recent research has shown that radiation is a major factor in heat loss in winter, and is to an even greater degree, a factor in heat gain in summer in any construction involving air spaces.

## Recent Research

Knowing that building insulation materials, properly used, make a tremendous contribution to comfort, operating economy and even in simpler housekeeping, it seems desirable to tell you briefly about 2 comprehensive research programs sponsored by the writer's company. Although the principles and values of fibrous and certain types of aluminum-clad insulation have been firmly established for some time, scientifically developed technical data in regard to the importance of radiation has not been complete. Very little was known about the value of reflective surfaces when used in combination with fibrous or mass insulation.

Accordingly, two research projects were sponsored—one at the National Bureau of Standards, and the other at The Pennsylvania State University.

*National Bureau of Standards Project*: The purpose was to make a fundamental study of the heat transfer characteristics of reflective surfaces in combination with bulk insulating materials in confined spaces. Fig. 4 lists the five basic directions of heat flow: horizontally, as through a wall outward or inward; vertically down, as through a flat roof heated by sun; down at 45 deg. as through gabled or sloped roof heated by sun; vertically up, as through a flat roof; and up at 45 deg. as through a gabled or sloped roof when inside is warmer than outside. A total of 154 separate tests were made during this study with insulation applied to all these basic flow directions. This research was completed in June 1956, and the results are published in the National Bureau of Standards' Building Materials and Structural Report #151 entitled, *Thermal Resistance of Air Spaces and Fibrous Insulations Bounded by Reflective Surfaces.*

Briefly, is was found that insulating values for the test panels were in agreement with calculated values within 10 percent or better in almost all cases. Somewhat wider variations between observed and calculated values were found for test panels as a result of such factors as the condensation of moisture on reflective surfaces, lack of uniformity of air space thickness, air circulation between tandem air spaces, and effects attributed to local high conductances at edges of insulating blankets or radiation from framing members. With adequate insulation it was found that these disturbances were minor. Much of this data will assist in evaluating the seriousness of improper application and assist manufacturers of insulation products in providing even better insulations in the future.

*The Pennsylvania State University Project*: The purpose was to determine the value in summer and winter of a reflective breather in combination with fibrous insulation in various attic space applications. Included were all applications normally found beneath a flat roof with a low attic and beneath a gabled roof with various rates of attic ventilation. In addition, the performance of reflective elements alone was determined.

These tests were made in the University's Climatometer (Fig. 5)—a large chamber in which almost any condition of atmospheric temperature and humidity can be created. A laboratory test house was built in this chamber,

heat flow meters were placed throughout and a series of 31 summer-type attic tests were conducted.

Briefly, these tests demonstrated that aluminum-clad insulation performs its greatest service in summer in ventilated or non-ventilated attics and with either flat roof or gabled roof designs when heat flow is downward. In addition, it was found that under summer conditions all attics should have maximum natural ventilation or mechanical ventilation up to the point of moving 1.5 cfm per sq ft of floor area. Air movement greater than this amount

1. DOWN AT 45 DEG
2. UP AT 45 DEG
3. HORIZONTALLY
4. VERTICALLY DOWN
5. VERTICALLY UP

**Fig. 4 — List of the 5 basic directions of heat flow included in NBS project**

was found to improve the thermal value of the ceiling very little. Proof was shown that the right amount of insulation is essential for the most efficient heat-proofing performance.

*Heat Transmission Calculations*: Both of these research projects had a common principal objective, *viz*: to provide scientific data that would make it possible to calculate heat transmission values accurately and easily when aluminum is used either alone or in combination with other insulating products.

The findings definitely indicate that adequate insulation is more important for summer air conditioning than for winter heating. The main objections to air conditioning have been high purchase price and high operating costs. Usually both can be lowered by adequate insulation against summer heat, particularly sun heat.

Adequate summer insulation could mean the difference between a 4-ton and a 2-ton air conditioner in an average-size house. The difference in initial cost between the 2 units is considerable; so is the difference in operating cost. The additional expense of the larger unit may be 2 to 3 times as great as the total cost of the insulation.

One of the important new facts developed is that the long-accepted law of diminishing returns needs a drastic overhaul—at least when applied to building insulation. Theoretically, the first unit of insulation does the most good, and a subsequent increase in the quantity of insulation does progressively less. It is a fallacy to think that cost goes up as the quantity of insulation is increased. The reason why cost does not necessarily rise in proportion is because labor is such a large factor and labor costs do not change materially with quantities of insulation.

With the use of adequate insulation, equipment sizes can be reduced. A builder can save $35 to $50 when he drops one commercial size in heating units, and around $200 when he drops one ton in cooling capacity. When this fact is realized it is frequently found that the last unit of insulation, instead of the first unit, makes the biggest initial saving. Obviously the breakpoint varies with individual houses and with climatic conditions, but in general tests indicate that the best results come from the maximum use of insulation.

### Factors Affecting Performance of Insulation

While heat movement cannot be stopped, its flow can be retarded. There are two general types of products which serve this function. One type uses trapped air. This

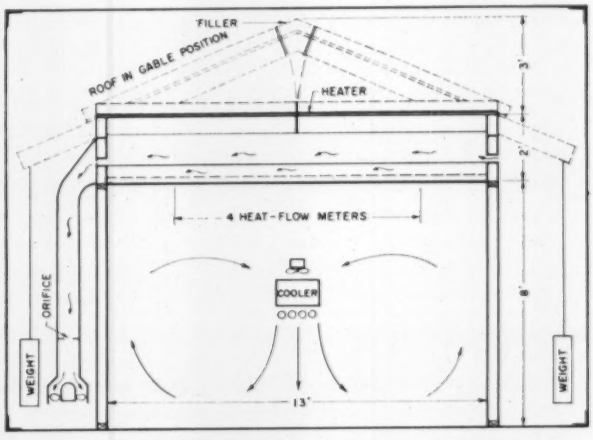


**Fig. 5 — Section showing test house built in controlled room at PSU project**

is the fibrous type. The second type uses heat-reflective materials in conjunction with air spaces. In many instances a product combining these two principles is utilized.

The efficiency of insulations using the trapped air principle is dependent upon 4 things. *First*, the ability of the material forming the fibers or cells to conduct heat along their length affects insulating efficiency. Fine fibers are better than coarse fibers. *Second*, as illustrated in Fig. 6, the contact of individual fibers or cell walls with each other affects the rate of heat flow by conduction through the solid elements. Hard cylindrical fibers transmit less heat than soft flat fibers. *Third*, the direction of heat flow by conduction through the solid elements affects the rate of heat movement (See Fig. 7). Heat travels faster par-

allel to the fibers than across the fibers. *Fourth*, density or size of the air particles is very important. High density materials have fibers packed close together so that heat travels directly from one fiber to another by conduction. Low density materials have few fibers and large spaces which increase heat loss due to convection. The ideal

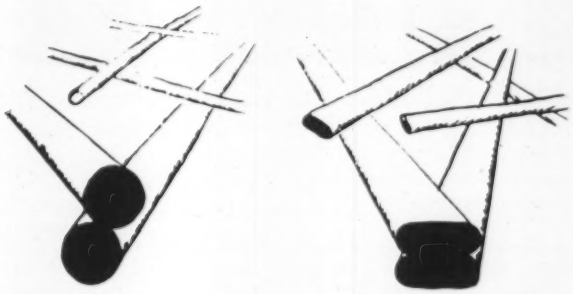

**Fig. 6 — Illustration of how fiber cross-sectional shape affects heat movement in insulating materials**

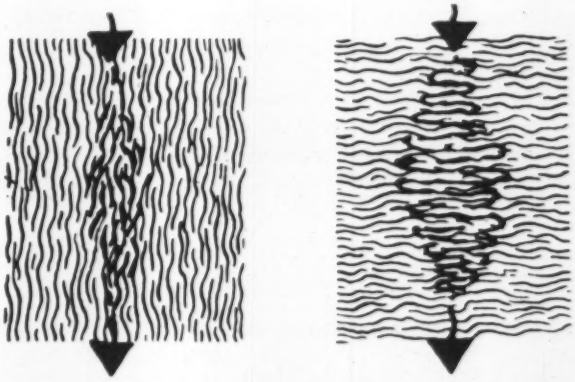

**Fig. 7 — Heat travels more readily by conduction parallel to fibers than across them**

density would stop convection currents, and at the same time minimize heat transfer by conduction.

The *method of application* affects performance of both reflective and fibrous insulation. Important factors in this regard are listed in Fig. 8, and the following remarks apply to them.

1. Position of Air Space—The value varies depending on whether it is horizontal, vertical or sloping.

2. Direction of Heat Flow—Reflective insulation is more efficient when heat flow is down.

3. Width of Air Space—Width should be about ¾ in.; spaces wider than ¾ in. do not appear to have any more value except when heat flow is down.

4. Shape of Air Space—The highest efficiency is obtained from uniform width air spaces.

5. Temperature Difference—The smaller the difference in temperature between the two sides of an air space, the better the insulating value.

**1. POSITION OF AIR SPACE**
**2. DIRECTION OF HEAT FLOW**
**3. WIDTH OF AIR SPACE**
**4. SHAPE OF AIR SPACE**
**5. TEMPERATURE DIFFERENCE**
**6. MEAN TEMPERATURE**
**7. EMISSIVITY OF SURFACES**

**Fig. 8 — Seven important application factors affecting the performance of both reflective and fibrous insulations**

6. Mean Temperature—The air space resistance is slightly higher under winter conditions than in summer.

7. Emissivity of Surfaces—Emissivity indicates the relative amount of radiant energy which is absorbed by a surface. In general, tests show that many materials reflect 10 percent and absorb

**1. BATT AND BLANKET INSULATIONS**
**2. LOOSE FILL INSULATIONS**
**3. INSULATION BOARD**

**Fig. 9 — List of 3 classes of fibrous insulations**

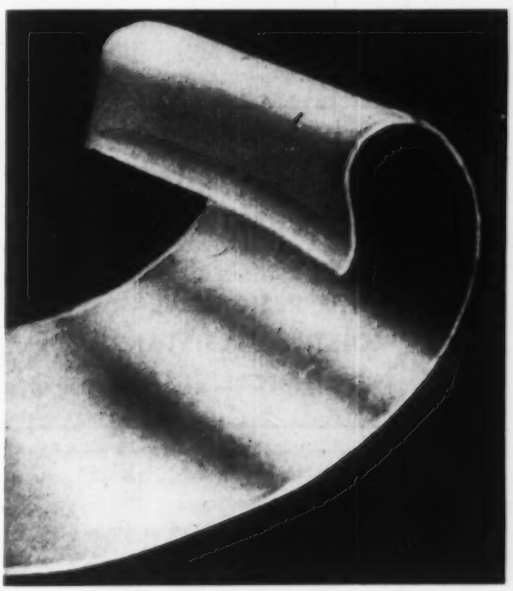

**Fig. 10 — Reflective insulation is available as foil in blanket form**

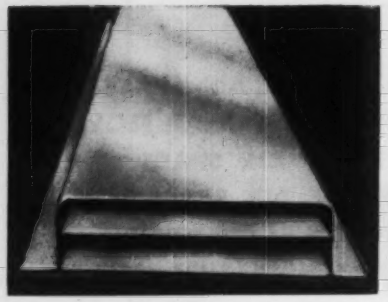

Fig. 11 — Example of reflective building insulation product in form which gives multiple surfaces

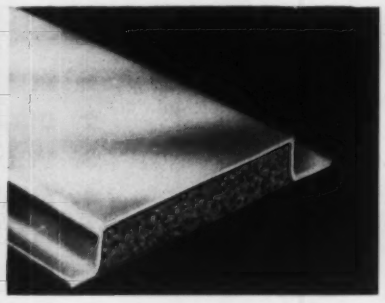

Fig. 12 — Reflective insulation material combined with a fibrous material

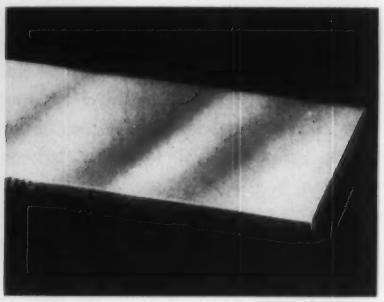

Fig. 13 — Combination of reflective insulating material with a board type of material

90 percent. Bright aluminum foil reflects 95 to 97 percent and absorbs 3 to 5 percent of the radiant portion of heat transferred across an air space.

## Basic Types of Insulation

The basic types of insulation are divided into three general groups. These are fibrous insulations, reflective insulations, and plastics.

*Fibrous Insulations*: Fibrous insulations may be classified as listed in Fig. 9, and as further clarified by the following comments.

1. Batt and blanket insulations are made of mineral, cotton or wood fibers to a controlled density.
2. Loose fill insulations are generally made of wood or mineral fibers or vermiculite granules. The density of these products varies depending upon the material and the method of application.
3. Insulation board which is made of wood, cane, or other organic fibers in various sizes, thicknesses and densities.

*Reflective Insulations*: Reflective insulation products are available in several forms but all operate on the same principle. Typical ones are illustrated in Figs. 10, 11, 12, and 13, and can be classified as follows:

1. Foil in blanket form which, when applied, forms multiple reflective air spaces.
2. Single sheet products including aluminum foil, or foil bonded to paper or polished aluminum flakes on paper. These single sheets are installed in a manner to provide individual air spaces.
3. Fibrous insulation faced or enclosed either with aluminum foil or paper coated with flaked pigment or a combination of both.
4. Reflective foil laminated to one surface of insulating board or plasterboard.

*Plastic Insulations*: Several types of plastic materials are being used successfully. These include foam polystyrene and polyurethane. New uses and new types of products are being developed almost daily in this field.

1. EFFICIENT
2. PERMANENT
3. EASE OF APPLICATION
4. HAZARD RESISTANT
5. WIND RESISTANCE
6. MOISTURE RESISTANT
7. ECONOMICAL

Fig. 14 — List of 7 requirements which a good insulation product should meet

## Requirements of a Good Insulation

Inasmuch as those persons responsible for specifying insulation are interested in getting the best possible products, the author would like to list the following requirements which in his opinion are essential for a good insulation product, and which for convenience of reference have been listed on Fig. 14.

1. Efficient—Insulation when installed must be able to reduce heat loss in winter and heat gain in summer.
2. Permanent—Insulation should last the life of the building.
3. Ease of application.
4. Hazard Resistant—Insulation should be able to retard the spread of fire through enclosing structures without adding combustible elements.
5. Wind Resistant—Protection against wind and convection air currents is necessary to assure highest performance and efficiency.
6. Moisture Resistant—Insulation must be kept dry. In general this can be accomplished by providing good vapor barriers.
7. Economical—Good insulation is one of the few materials used in a house that will pay for itself by reducing the size of the heating unit and the air-conditioning equipment, and by lowering the cost of heating in winter and cooling in summer.

As a result of the information available from recent research work, it is believed that it is now possible to produce insulation products which will meet the foregoing requirements. In addition, if architects, builders, and insulation contractors will take advantage of the information and products now available, this will lead to better insulated buildings which will be more comfortable and which can be operated more economically.

# A New Method for Calculating Radiant Exchanges

Benjamin Gebhart*, Ithaca, N. Y.

**SUMMARY— A new method for the analysis of thermal radiant energy transfer processes is discussed as it applies to the problem of calculating radiant energy transfer between the surfaces of an enclosure such as a panel-heated room. This method reduces the calculations for gray surface enclosures to a form very similar to that which may be used for enclosures made up only of black surfaces.**

**The general technique is presented along with the necessary definitions and equations. The method is then applied to the calculation of the radiant energy loss rates for a floor panel under various room surface conditions. Special characteristics of this method of analysis are emphasized next by calculating the radiant energy losses of a window and by determining the temperature of the adiabatic surfaces in a room. A program of analysis and calculation is recommended which would simplify the application of the method to design calculations.**

Most methods[1,2] for the determination of instantaneous radiant energy transfer rates between the gray surfaces of an enclosure (See, for example, Fig. 1) consider net transfer rates between pairs of surfaces. These net transfer rates are often ill-defined and awkward to use. Their calculation is difficult and involved in complicated enclosures. Further, the net transfer rate between two of the surfaces of an enclosure made up of many surfaces has no physical significance. It is not the rate of radiant energy loss or gain of either surface.

The present author has recently developed[3] a method of analysis which does not employ the net transfer method of energy analysis. Instead, attention is focused upon the total rate of radiant energy loss of a surface. The rate of loss is calculated by taking into account all of the radiant energy effects to which the surface is subject due to its surroundings. Only one energy quantity need be found for each surface and this quantity is equal to the instantaneous rate of energy loss by the surface due to radiation effects.

This rate of loss of a surface is defined as the rate of radiant energy emission by the surface minus the total rate of absorption of radiant energy at the surface. The absorption rate is calculated by taking into account all of the effects of the radiant surroundings, including all emissions and reflections. This instantaneous rate of loss has direct physical significance. It would be used in an energy balance for the surface just as the convection and conduction transfer rates are. In steady state, *i.e.*, the surface temperature not changing with time, the sum of the rates of radiant, convection, and conduction losses would be zero. In unsteady states this sum would be equal to the time rate of decrease of stored energy in the material of which the surface is made.

The rate of loss defined in this way is, therefore, similar to other quantities defined in heat transfer and is directly useful. For example, in a room heated by a radiant floor panel the necessary rate of energy supply by the embedded coils would be the sum of the rate of loss by convection and the rate of loss by radiation as defined above. The convection loss may be calculated using the information on convection recently reported[4].

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[1]Exponent numerals refer to References.

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## General Analysis

Before applying the new method for several enclosure calculations, a brief account of the development is necessary. The relevant equations are presented and the significance of various quantities is discussed.

The rate of loss of a surface is defined as its emission rate minus the total rate of absorption of radiant energy from all sources. This rate of loss is affected by the emission rates of all the surfaces present, by their geometric relation with each other, and by their tendency to reflect radiant energy. Therefore, in order to find this rate of loss one must take into account the total radiant surroundings of the surface of interest and account for all paths by which radiant energy travels. The surface and its total surroundings may be considered an *enclosure* even though some of the enclosing surfaces have peculiar characteristics. For example, an opening transmits all radiant energy encountering it and emits none.

For an enclosure made up of $n$ surfaces $A_1, A_2, \ldots, A_n$, an expression for the rate of loss of any one of them, called $A_j$, will be written. This quantity, called $q_j$, will be equal to the emission rate, $W_jA_j$, minus the absorption rates at $A_j$ of a portion of the radiant emission from each of the $n$ surfaces of the enclosure. If non-black surfaces are present these absorption rates must include direct incidence and all paths of reflections. A new quantity, similar to the angle factor, is called the absorption factor and is defined as the fraction of the

total emission of one surface which is absorbed by another surface, including all paths whereby the energy may travel. Considering surface $A_i$ which emits at a rate $W_iA_i$, $B_{ij}$ is the absorption factor of $A_j$ for the radiant emission of $A_i$. That is, $B_{ij}$ is the fraction of the emission of $A_i$ which is absorbed at $A_j$. Therefore, $A_j$ absorbs energy from $A_i$ at a rate of $B_{ij}$ $W_iA_i$. The rate of loss equation is then written in these terms for $A_j$:

$$q_j = W_jA_j - B_{1j}W_1A_1 - B_{2j}W_2A_2 \cdots - B_{jj}W_jA_j \cdots - B_{nj}W_nA_n$$

$$= W_jA_j - \sum_{i=1}^{n} B_{ij}W_iA_i \quad \cdots\cdots (1)$$

Any enclosure surface may be taken as $j$. Note that some of $W_jA_j$ may be reabsorbed at $A_j$; that is, $B_{jj}$ is not necessarily zero.

Equation 1 is very similar to the one which would be written for an enclosure of black surfaces. The absorption factors would be replaced by angle factors and the emission rates would be those of black surfaces. This similarity provides the basis for an interpretation of the meaning of absorption factors. They are generalized angle factors between the surfaces of a non-black enclosure.

There are $n$ absorption factors and they may be found by summing the absorption rates at $A_j$ due to the emission rates and reflections at the other surfaces. For $B_{1j}$, $W_1A_1$ is emitted by $A_1$, $F_{1j}\epsilon_j$ is directly absorbed at $A_j$, and $F_{1j}\rho_j$ is reflected. Now the fraction of $F_{1j}\rho_j$ which is eventually absorbed at $A_j$ is the same as the fraction of $W_jA_j$ which is eventually absorbed at $A_j$, because the available paths are identical for the two quantities of radiant energy. Therefore, $F_{11}\ \rho_1\ B_{1j}$ is absorbed by $A_j$. Similarly $F_{12}\ \rho_2$ is reflected from $A_2$ and $F_{12}\ \rho_2\ B_{2j}$ is eventually absorbed at $A_j$. $B_{1j}$ is then written as:

$$B_{1j} = F_{1j}\epsilon_j + F_{11}\rho_1B_{1j} + F_{12}\rho_2B_{2j} + F_{13}\rho_3B_{3j} + \cdots F_{1n}\rho_nB_{nj}$$

Similar expressions are written for each surface and the results are rearranged in the $n$ equations below. Note that $F_{k1}\ \rho_1$ is redesignated as $\alpha_{k1}$ for simplicity.

$$\left.\begin{aligned}
&(\alpha_{11}-1)B_{1j} + \alpha_{12}B_{2j} + \alpha_{13}B_{3j} + \cdots + \alpha_{1n}B_{nj} + F_{1j}\epsilon_j = 0\\
&\alpha_{21}B_{1j} + (\alpha_{22}-1)B_{2j} + \alpha_{23}B_{3j} + \cdots + \alpha_{2n}B_{nj} + F_{2j}\epsilon_j = 0\\
&\alpha_{31}B_{1j} + \alpha_{32}B_{2j} + (\alpha_{33}-1)B_{3j} + \cdots + \alpha_{3n}B_{nj} + F_{3j}\epsilon_j = 0\\
&\quad \text{etc. to}\\
&\alpha_{n1}B_{1j} + \alpha_{n2}B_{2j} + \alpha_{n3}B_{3j} + \cdots (\alpha_{nn}-1)B_{nj} + F_{nj}\epsilon_j = 0
\end{aligned}\right\} (2)$$

This set of equations may be solved for the $n$ unknowns $B_{1j}$, $B_{2j}$, . . . $B_{nj}$ as indicated in the original paper.[3] The foregoing set of equations is valid, with the same coefficients, for any choice of $j$, *i.e.*, 1, 2, . . . . $n$. Therefore, Equations 1 and 2 may be applied to any surface of the enclosure.

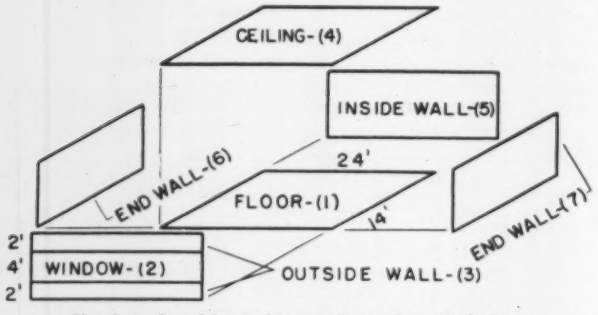


**Fig. 1 — Panel-heated room chosen for calculations**

In an enclosure formed of $n$ surfaces there are $n^2$ angle factors. However, as shown in Equations 3 and 4, there are necessary relations between the angle factors and one need not find all $n^2$ values from geometric considerations.

$$\sum_{j=1}^{n} F_{ij} = 1 \quad \cdots\cdots (3)$$

$$F_{ij}A_i = F_{ji}A_j \quad \cdots\cdots (4)$$

Similarly, there are necessary relations of the same form between absorption factors[3] which simplify calculations.

$$\sum_{j=1}^{n} B_{ij} = 1 \quad \cdots\cdots (5)$$

$$B_{ij}\epsilon_iA_i = B_{ji}\epsilon_jA_j \quad \cdots\cdots (6)$$

Equations 1, 2, 5 and 6 complete the basic information necessary for the use of the new technique.

*Special Surfaces*: All types of thermal radiation problems are included under the *enclosure* method just outlined. However, some enclosures possess surfaces having very special properties in radiation exchange processes. Three such special kinds of surfaces are the window, the opening, and the adiabatic surface. Such surfaces are frequently encountered in room calculations. The characteristic of the opening is that it transmits all radiation encountering it and radiation may enter the enclosure across it. The window absorbs, reflects and transmits. The

### Nomenclature

$A_j$ = area of the $j$th surface, $j$ = 1,2,3, . . . . $n$.
$B_{ij}$ = absorption factor, the fraction of the energy leaving $A_i$, uniformly, which is absorbed by $A_j$.
$F_{ij}$ = angle factor from $A_i$ to $A_j$.
$n$ = total number of surfaces in an enclosure.
$q_j$ = the net rate of energy loss from $A_j$ due to thermal radiation processes.
$T$ = absolute temperature.
$W$ = emissive power per unit area and time = $\epsilon\sigma T^4$.
$\alpha_{k1}$ = $F_{k1}\rho_1$.
$\epsilon$ = emissivity.
$\rho$ = reflectivity = 1 − $\epsilon$ for opaque surfaces.
$\sigma$ = 0.1713 x $10^{-8}$ Btu per (sq ft) (hr) (Rankine)$^4$.
$\tau$ = transmissivity of a window.

**Table 1 — General enclosure quantities**

| Surface | Surface Condition | Area | Reflectivity, $\rho$ | Emissivity, $\epsilon$ | Angle Factor to: 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 80 F | 336 | 0 | 1.00 | 0 | 0.087 | 0.088 | 0.454 | 0.175 | 0.098 | 0.098 |
| 2[a] | 45 F | 96 | 0.05 | 0.90 | 0.304 | 0 | 0 | 0.304 | 0.180 | 0.106 | 0.106 |
| 3 | 60 F | 96 | 0.10 | 0.90 | 0.308 | 0 | 0 | 0.304 | 0.184 | 0.102 | 0.102 |
| 4 | adia. | 336 | 0.10 | 0.90 | 0.454 | 0.087 | 0.088 | 0 | 0.175 | 0.098 | 0.098 |
| 5 | adia. | 192 | 0.10 | 0.90 | 0.306 | 0.090 | 0.092 | 0.306 | 0 | 0.103 | 0.103 |
| 6 | adia. | 112 | 0.10 | 0.90 | 0.294 | 0.091 | 0.087 | 0.294 | 0.178 | 0 | 0.054 |
| 7 | adia. | 112 | 0.10 | 0.90 | 0.294 | 0.091 | 0.087 | 0.294 | 0.178 | 0.054 | 0 |

[a]The glass transmissivity and absorptivity for low temperature radiation are taken as $\tau = 0.05$ and $\alpha = 0.90$.

adiabatic surface has the characteristic of absorbing and emitting radiation in equal amounts.

If a window or opening transmits all radiation it is assigned a reflectivity of 0. If radiant energy enters the enclosure through a window or opening in sufficient quantities to be important in radiant exchange calculations, this energy quantity is accounted for by ascribing the necessary radiation characteristics to the equivalent window or opening surface.

The characteristic of an adiabatic surface, to absorb and emit at an equal rate, is simulated in this analysis by assuming that the surface absorbs and emits nothing. Its properties are taken as $\rho = 1.0$ and $\epsilon = 0$. That is, it is assumed to act as a perfect reflector. The present method offers a very convenient means of calculating the temperatures of adiabatic surfaces. This technique is demonstrated in the following calculations.

*Radiation Transfer Rate Calculations*: Calculations are presented below for radiation transfer rates and temperatures for various conditions in the typical 24 × 14 × 8 ft room diagrammed in Fig. 1. The 3 inside walls and ceiling are assumed adiabatic considering only radiation exchanges. The floor is a radiant panel. The outside wall and window exchange radiant energy with the floor. The surface properties and angle factors are listed in Table 1. The floor is assumed covered with a fabric which renders it essentially black.

Four different calculations are shown for this room. The floor radiant energy loss rate is calculated

**Table 2 — Enclosure quantities with the 4 adiabatic surfaces combined**

| Surface | Surface Condition | Area, sq ft | Reflectivity, $\rho$ | Emissivity, $\epsilon$ | Angle Factor to: 1 | 2 | 3 | a |
|---|---|---|---|---|---|---|---|---|
| 1 | 80 F | 336 | 0 | 1.0 | 0 | 0.087 | 0.088 | 0.825 |
| 2 | 45 F | 96 | 0.05 | 0.90 | 0.304 | 0 | 0 | 0.696 |
| 3 | 60 F | 96 | 0.10 | 0.90 | 0.308 | 0 | 0 | 0.692 |
| a | adia. | 752 | 1.0 | 0 | 0.369 | 0.089 | 0.088 | 0.454 |

| Surface | $T$ (abs) | $W = \epsilon \sigma T^4$ | $WA \times 10^{-3}$ | $F_{i1}$ | $\alpha_{k1}$[a] 1 | 2 | 3 | a |
|---|---|---|---|---|---|---|---|---|
| 1 | 540 | 145.66 | 48.941 | 0 | 0 | 0.0044 | 0.0088 | 0.825 |
| 2 | 505 | 100.27 | 9.626 | 0.304 | 0 | 0 | 0 | 0.696 |
| 3 | 520 | 112.72 | 10.821 | 0.308 | 0 | 0 | 0 | 0.692 |
| a | ... | 0 | 0 | 0.369 | 0 | 0.0044 | 0.0088 | 0.454 |

[a] to be used in Equations 2.

**Table 3 — Enclosure quantities with only two adiabatic surfaces combined**

| Surface | Surface Condition | Area | Reflectivity $\rho$ | Emissivity $\epsilon$ | Angle Factor to: 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 80 F | 336 | 0 | 1.00 | 0 | 0.087 | 0.88 | 0.454 | 0.175 | 0.196 |
| 2 | 45 F | 96 | 0.5 | 0.90 | 0.304 | 0 | 0 | 0.304 | 0.180 | 0.212 |
| 3 | 60 F | 96 | 0.10 | 0.90 | 0.308 | 0 | 0 | 0.304 | 0.184 | 0.204 |
| 4 | adia. | 336 | 1.0 | 0 | 0.454 | 0.087 | 0.088 | 0 | 0.175 | 0.196 |
| 5 | adia. | 192 | 1.0 | 0 | 0.306 | 0.090 | 0.092 | 0.306 | 0 | 0.206 |
| 6 | adia. | 224 | 1.0 | 0 | 0.294 | 0.091 | 0.088 | 0.294 | 0.179 | 0.054 |

| Surface | $T$ (abs) | $W = \epsilon \sigma T^4$ | $WA \times 10^{-3}$ | $F_{i1} \epsilon_i$ | $\alpha_{k1}$ 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 540 | 145.66 | 48.941 | 0 | 0 | 0.0044 | 0.0088 | 0.454 | 0.175 | 0.196 |
| 2 | 505 | 100.27 | 9.626 | 0.304 | 0 | 0 | 0 | 0.304 | 0.180 | 0.212 |
| 3 | 520 | 112.72 | 10.821 | 0.308 | 0 | 0 | 0 | 0.304 | 0.184 | 0.204 |
| 4 | ... | 0 | 0 | 0.454 | 0 | 0.0044 | 0.0088 | 0 | 0.175 | 0.196 |
| 5 | ... | 0 | 0 | 0.306 | 0 | 0.0045 | 0.0092 | 0.306 | 0 | 0.206 |
| 6 | ... | 0 | 0 | 0.294 | 0 | 0.0045 | 0.0088 | 0.294 | 0.179 | 0.054 |

grouping the 4 adiabatic surfaces into one as a first approximation. The calculation is then repeated grouping only the 2 end walls into a single surface and results are compared. Next, the radiant losses involving the window are calculated. Finally, the average adiabatic surface temperature is calculated.

### Floor Loss Calculations

(*a*) With the 4 adiabatic surfaces grouped into one, hereafter called $A_a$, we have a 4-surface enclosure with characteristics as listed in Table 2. There are 4 absorption factors and four equations between them of the form of Equations 2.

$$(\alpha_{11}-1)B_{11}+\alpha_{12}B_{21}+\alpha_{13}B_{31}+\alpha_{1a}B_{a1}+F_{11}\epsilon_1=0$$
$$\alpha_{21}B_{11}+(\alpha_{11}-1)B_{21}+\alpha_{23}B_{31}+\alpha_{2a}B_{a1}+F_{21}\epsilon_1=0$$
$$\alpha_{31}B_{11}+\alpha_{32}B_{21}+(\alpha_{33}-1)B_{31}+\alpha_{3a}B_{a1}+F_{31}\epsilon_1=0$$
$$\alpha_{a1}B_{11}+\alpha_{a2}B_{21}+\alpha_{a3}B_{31}+(\alpha_{aa}-1)B_{a1}+F_{a1}\epsilon_1=0$$

The $\alpha_{k1}$ values and constants are computed from the $F$, $\rho$ and $\epsilon$ values and are listed in Table 2. Note that since $\rho_a = 1.0$, $\epsilon_a = 0$ and $W_a = 0$, only the first 3 absorption factors need be computed. The equations are:

$$-B_{11} + 0.0044B_{21} + 0.0088B_{31} + 0.825B_{a1} + 0 = 0$$
$$0 - B_{21} + 0\ B_{31} + 0.696B_{a1} + 0.304 = 0$$
$$0 + 0\ B_{21} - B_{31} + 0.692B_{a1} + 0.308 = 0$$
$$0 + 0.0044B_{21} + B_{31} + (1 - 0.454)B_{a1} + 0.369 = 0$$

From which $B_{11} = 0.5836$, $B_{21} = 0.7875$, and $B_{31} = 0.7890$. The rate of loss from the floor is found as:

$$q_1 = W_1A_1 - B_{11}W_1A_1 - B_{21}W_2A_2 - B_{31}W_3A_3 - B_{a1}W_aA_a$$
$$= 10^3(48.94 - 28.56 - 7.58 - 8.54) = 4260 \text{ Btu per hr}$$

(*b*) If only the end walls are grouped into one surface, called $A_b$, a 6-surface enclosure results. Table 3 summarizes the properties, angle factors, and $\alpha_{k1}$ values. Six equations result for the 6 absorption factors $B_{11}$, $B_{21}$, $B_{31}$, $B_{41}$, $B_{51}$, $B_{b1}$. However, since $\epsilon_4$, $\epsilon_5$ and $\epsilon_b$ are zero the last three factors need not be found.

$$-B_{11}+0.0044B_{21}+0.0088B_{31}+0.454B_{41}+0.175B_{51}+0.196B_{b1}+0=0$$
$$0-B_{21}+0+0.304B_{41}+0.180B_{51}+0.212B_{b1}+0.304=0$$
$$0+0-B_{31}+0.304B_{41}+0.184B_{51}+0.204B_{b1}+0.308=0$$
$$0+0.0044B_{21}+0.0088B_{31}-B_{41}+0.175B_{51}+0.196B_{b1}+0.454=0$$
$$0+0.0045B_{21}+0.0092B_{31}+0.306B_{41}-B_{51}+0.206B_{b1}+0.306=0$$
$$0+0.0045B_{21}+0.0088B_{31}+0.294B_{41}+0.179B_{51}-0.946B_{b1}+0.294=0$$

Solution of these equations yields $B_{11} = 0.5838$, $B_{21} = 0.7845$ and $B_{31} = 0.7858$. The rate of radiant energy loss is computed as before.

$$q_1 = W_1A_1 - B_{11}W_1A_1 - B_{21}W_2A_2 - B_{31}W_3A_3$$
$$= 10^3(48.94 - 28.57 - 7.55 - 8.50) = 4316 \text{ Btu per hr}$$

Comparison of the answers of calculations (*a*) and (*b*) show that combining all of the adiabatic surfaces into one produced only something over 1 percent error in the energy loss of the floor panel. Such uncertainties are certainly unimportant and the combination of several areas having the same properties is usually permissible. The error may become more important, however, for surfaces having lower emissivities.

### Radiation Calculations for a Window

The rate of radiant energy loss from the inside surface of the window (to the room surfaces) of Fig. 1 is next calculated, grouping all adiabatic surfaces into one area. The rate of radiant energy transmission from the room to the outside through the window is also computed.

**Table 4 — Enclosure quantities ( actual properties for all surfaces)**

| Surface | Reflectivity, $\rho$ | Emissivity, $\epsilon$ | $WA \times 10^3$ | $F_{1a}\epsilon_a$ | $\alpha_{k1}$ | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | a |
| 1 | 0 | 1.0 | 48.941 | 0.742 | 0 | 0.0044 | 0.0088 | 0.0825 |
| 2 | 0.05 | 0.90 | 9.626 | 0.626 | 0 | 0 | 0 | 0.0696 |
| 3 | 0.10 | 0.90 | 10.821 | 0.623 | 0 | 0 | 0 | 0.0692 |
| a | 0.10 | 0.90 | Unknown | 0.404 | 0 | 0.0044 | 0.0088 | 0.0454 |

The absorption factors $B_{12}$, $B_{22}$, and $B_{32}$ are found from the following equations as 0.1978, 0.1006, and 0.1000 respectively. The $\alpha_{k1}$ values are the same as used for computing the floor loss. They are listed in Table 2. The rate of loss from the inside window surface, $q_2$, is then found.

$$(\alpha_{11} - 1)B_{12} + \alpha_{12}B_{22} + \alpha_{13}B_{32} + \alpha_{1a}B_{a2} + F_{12}\epsilon_2 = 0$$
$$\alpha_{21}B_{12} + (\alpha_{22} - 1)B_{22} + \alpha_{23}B_{32} + \alpha_{2a}B_{a2} + F_{22}\epsilon_2 = 0$$
$$\alpha_{31}B_{12} + \alpha_{32}B_{22} + (\alpha_{33} - 1)B_{32} + \alpha_{3a}B_{a2} + F_{32}\epsilon_2 = 0$$
$$\alpha_{a1}B_{12} + \alpha_{a2}B_{22} + \alpha_{a3}B_{32} + (\alpha_{aa} - 1)B_{a2} + F_{a2}\epsilon_2 = 0$$
$$q_2 = W_2A_2 - B_{12}W_1A_1 - B_{22}W_2A_2 - B_{32}W_3A_3$$
$$= 10^3(9.63 - 9.68 - 0.97 - 1.08) = -2100 \text{ Btu per hr}$$

The minus sign means that the window gains radiant energy from the surfaces inside of the room.

The amount of the radiation of the enclosure transmitted through the glass to the outside is calculated by observing that for every Btu incident upon the window, 0.90 Btu is absorbed and 0.05 Btu is transmitted. Now, the amount $B_{12}W_1A_1 + B_{22}W_2A_2 + B_{32}W_3A_3$ is absorbed by the window. Therefore, $1/\rho_2$ times this absorbed amount is incident and $\tau_2/\rho_2$ is transmitted. The transmitted amount, $q_T$, is, therefore,

$$q_T = (B_{12}W_1A_1 + B_{22}W_2A_2 + B_{32}W_3A_3)\ \tau_2/\rho_2$$
$$= (9.68 + 0.97 + 1.08) \times 10^3 \times 0.05/0.90 = 650 \text{ Btu per hr}$$

This is seen to be a small quantity. For an opening, having $\tau = 1.0$, the amount would be much greater.

Another convenient aspect of this method of analysis is that the sum of all the surface heat losses and transmissions as defined here is equal to zero. Therefore, $q_3$ may be found from the results of the previous calculations directly.

$$q_1 + q_2 + q_3 - q_T = 0$$
$$q_3 = q_T - q_1 - q_2 = 650 - 4260 + 2100 = -1510 \text{ Btu per hr}$$

### Average Temperatures of Adiabatic Surfaces

In the preceding calculations the characteristic of an adiabatic sur-

face, to absorb and emit at an equal rate, was simulated by assigning to the surface the fictitious properties $\rho_a = 1.0$ and $\varepsilon_a = 0$. No absorption and no emission certainly guarantees that the surface will be adiabatic. However, in order to calculate adiabatic surface temperatures these surface properties may not be used. The surface temperature results from the fact that the emission rate must equal the rate of total energy absorption. The actual surface properties are used.

The solution of this equation for $T_a$ is more difficult; therefore, an approximate technique would be employed.

The adiabatic condition is fulfilled by requiring that the rate of loss, $q_a$, is zero. Therefore, the expression for $q_a$ is found in terms of the absorption factors, the known emission rates, and the areas. $W_a$ is then found and from this $T_a$ is computed.

The absorption factors $B_{1a}$, $B_{2a}$, $B_{3a}$ and $B_{aa}$ are found from the following equations. Some $\alpha_{kl}$ values are different from those used in the preceding calculations because of the different surface properties now assigned to $A_a$. The constant terms in the equations are now $F_{1a}\varepsilon_a$, $F_{2a}\varepsilon_a$, $F_{3a}\varepsilon_a$, and $F_{aa}\varepsilon_a$. This information is summarized in Table 4.

$$-B_{1a} + 0.0044B_{2a} + 0.0088B_{3a} + 0.0825B_{aa} + 0.742 = 0$$
$$0 - B_{2a} + 0 + 0.0696B_{aa} + 0.626 = 0$$
$$0 + 0 - B_{3a} + 0.0692B_{aa} + 0.623 = 0$$
$$0 + 0.0044B_{2a} + 0.0088B_{3a} + 0.955B_{aa} + 0.404 = 0$$

The absorption factors are found as $B_{1a} = 0.7865$, $B_{2a} = 0.6561$, $B_{3a} = 0.6529$, and $B_{aa} = 0.4321$. The expression for $q_a$ is written and solved for $W_a$. $T_a$ is then computed.

$$q_a = 0 = W_a A_a - B_{aa} W_a A_a - B_{1a} W_1 A_1 - B_{2a} W_2 A_2 - B_{3a} W_3 A_3$$
$$W_a = \frac{B_{1a} W_1 A_1 + B_{2a} W_2 A_2 + B_{3a} W_3 A_3}{A_a (1 - B_{aa})} = 118.7 \text{ Btu/(hr)(sq ft)}$$
$$T_a^4 = \frac{W_a}{\varepsilon_a \sigma} = 769.8 \times 10^8, \quad T_a = 527\text{R or } 67\text{F}$$

This temperature is an estimate of the average temperature of the surfaces, assuming that they are adiabatic from the radiation point of view.

If conduction through the surface and convection from the surface to the room air are present, the surface will be adiabatic from the radiation point of view only if the conduction and convection effects balance each other. In general these effects do not balance and the surface temperature is estimated from the surface energy balance. This balance includes: $q_a$ for radiation, $q_k$ for conduction, and $q_c$ for convection. The equation is

$$q_a + q_k + q_c = 0$$
$$W_a A_a - \sum_{i=1}^{n} B_{ia} W_i A_i + \frac{k A_a}{\Delta x}(T_a - T_o) + h_c A_a (T_a - T_r) = 0 \quad (7)$$

*where*

$T_a - T_o$ = conduction absolute temperature difference across the wall.
$T_r$ = absolute room air temperature.
$k$ = thermal conductivity of the wall material.
$h_c$ = average convection coefficient for the adiabatic surface.

## Summary and Recommendations

A new method of thermal radiation analysis for non-black surfaces is demonstrated by calculating various radiant energy transfer rates in a room. The analysis is direct and consistent because of the way in which basic quantities are defined and is similar to the approach used for black surfaces. The same basic technique is used in all calculations with only minor alterations.

In the calculations, as in any calculations which account for many processes simultaneously, the numerical operations are lengthy. The involved calculations arise in the solution of the equations for the absorption factors. For a many-surface enclosure, this is necessarily a machine calculation.

Since the major inconvenience in the use of the method is in connection with the calculation of absorption factors, the question arises as to whether or not the values of the absorption factors could be presented graphically. This is the standard practice for the similar quantity, angle factor. Perhaps it is also possible and practical to tabulate or graph complete solutions for the heat loss rate and to present design information directly.

A preliminary study indicates that much can be done along these lines for room-like enclosures. Room surface emissivitives, angle factors, and temperatures vary over relatively narrow ranges and many simplifications and approximations are possible. Therefore, if this method is adjudged of value in this application, it is recommended that studies be undertaken, first, to determine what is practical in the form of general solutions, and second, to make the calculations and to organize the results in a form applicable to design. In any case, it is considered desirable, as a first step, to present absorption factors graphically in order to facilitate various types of calculations such as those for adiabatic surface temperatures.

## Acknowledgment

The author wishes to express his thanks to C. O. Mackey for numerous helpful discussions and suggestions.

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# Surfacings for Glass Fiber and Foam Thermal Insulation

By

**W. P. Ellis**

The author is Director of Research, Benjamin Foster Co., Philadelphia, Pa. A presentation at the Symposium on Insulation at Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 24, 1958.

THE ACCEPTANCE and widespread use of new types of fibrous glass and foam thermal insulation over the past 10 years has stimulated the production of modern surfacing materials necessary to the proper service performance of these insulations.

## Insulation Materials

Fibrous glass insulation came into wide use during the late World War in combat vessels of the U. S. Navy, and it was the urgent need for fire resistant methods of surfacing fibrous glass insulation which led to the development of the modern surface coatings. Fibrous glass insulations have developed rapidly over the intervening period and today are available from several manufacturers in a wide range of physical forms and densities. Fig. 1 shows some of the varieties of forms and densities available.

One of the first foam materials to attain prominence in the thermal insulation field was glass foam, which found immediate acceptance in the low-temperature field. The plastics industry followed with the development of both rigid and flexible forms of cellular plastics having desirable thermal conductivities and service properties. The plastic foam which has gained widest current use is polystyrene. This insulation is now available as semi-rigid block and pipe covering either cut from rough-molded massive *logs* or molded to finished shape from expandable polystyrene beads. Rigid cellular rubber insulation board is also well known in the industry. Synthetic rubber and other flexible rubber-like elastomers foamed and molded or extruded as tubing now provide an efficient and labor-saving method for insulating small diameter cold pipes and tubing. Some plastic foams are available as flexible blankets. Fig. 2 illustrates some of the foam insulation materials available commercially.

Development of polyurethane foams for cushioning led directly to the production of foam blankets in large sections for insulating vessels and piping at lowered installation cost. The use of sprayed-on or poured-in-place polyurethane foam has not yet become a significant factor in the thermal insulation field, but there is no doubt that mechanical problems of application which have hindered wider use will be solved. Other elastomers and polymers such as silicones and fluorocarbons have potential use as foamed thermal insulation and they may eventually become economically feasible for more general use.

## Insulation Surfacing

All of these insulation materials require surfacing, either factory attached or field applied. The following list of design consideration for surfacings governs the selection of the proper coating.

## Design Considerations in Selection of Coating

1. Protection from water.
2. Protection from abuse.
3. Protection from fire.
4. Appearance (color).
5. Surfacing limitations.
6. Economy.

## Design Considerations

1. Water is probably the greatest enemy of thermal insulation. Absorbed water seriously reduces insulation efficiency. Surfacing, therefore, is required for weatherproofing, and for sealing insulation against penetration of water vapor. Even the non-absorptive insulation types require protective sealing at the joints which occur between sections of blocks, blankets, or pipe covering. Surfacing is desirable to prevent air movement through permeable insulation.

2. Surfacing is needed for protection from damage through physical abuse or from attack or absorption of solvents and active chemicals.

3. Non-combustible thermal insulation is a necessity for many services, and especially in air-conditioning systems for buildings. The surfacing materials used with non-combustible insulations must therefore have the necessary resistance to flame spread.

Several serious fires associated with insulation or surfacing have occurred in air-conditioning systems. A typical fire, caused by ignition of combustible vapor barrier on a non-combustible insulation, is shown in Fig. 3. It originated in the air-conditioning room in the basement from a short circuit above the refrigeration condenser equipment and ignited the vapor barrier on the ceiling, piping, and ducts. There was no smoke detection equipment to shut off air-circulating fans automatically and to close

dampers, so smoke entered the system through air make-up louvers in the room and spread through ducts to the occupied areas of the glass-walled, nine-story, fire-resistive building. The fire loss, due primarily to smoke, was $60,000, but near panic seized occupants of the upper stories

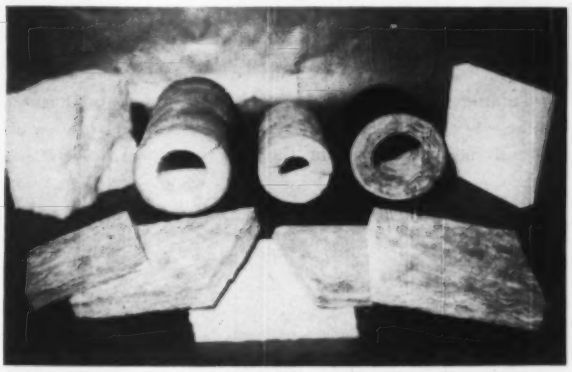


Fig. 1—Fibrous glass thermal insulation, typical forms and densities

some of whom broke out 2 large plate glass wall sections with a chair before firemen reached the level from aerial ladders.

Use of combustible insulation on air-conditioning ducts can lead to serious fire loss, such as the fire shown in Fig. 4 which occurred in a bowling alley in Baltimore, Md. The fire had apparently been smoldering in the combination warm air heating and air-conditioning system for some time and burst from the grilles of the supply ducts when the janitor turned on the heating system. Here the total loss

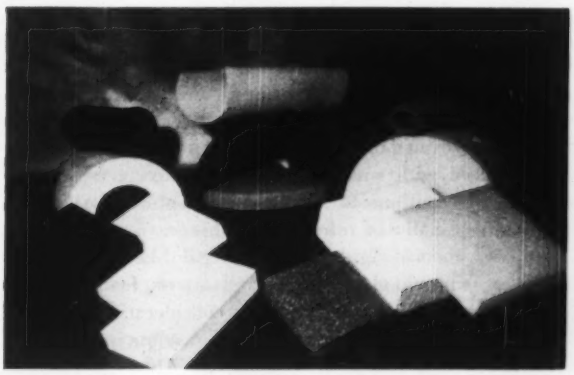


Fig. 2—Foam thermal insulation, typical forms and densities

was about $250,000. It is possible to reduce the hazard from combustible insulation with incombustible or fire-resistive surfacing. *NFPA* Standard 90A covers safe practices in the installation of air-conditioning and ventilating systems of other-than-residence type and this standard is

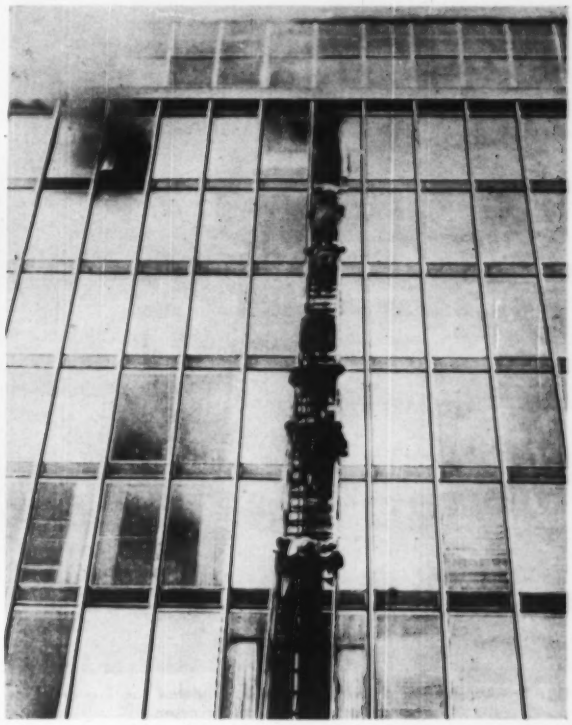


Fig. 3—Fire originating in air-conditioning system caused building damage from smoke and panic

being adopted in municipal and state fire codes. These 2 typical fires serve to emphasize the need for fire resistive construction in air-conditioning systems. Fire resistive surfacings for thermal insulation meeting the requirements of this standard are available.

Fig. 4—Fire involving combustible thermal insulation in air-conditioning

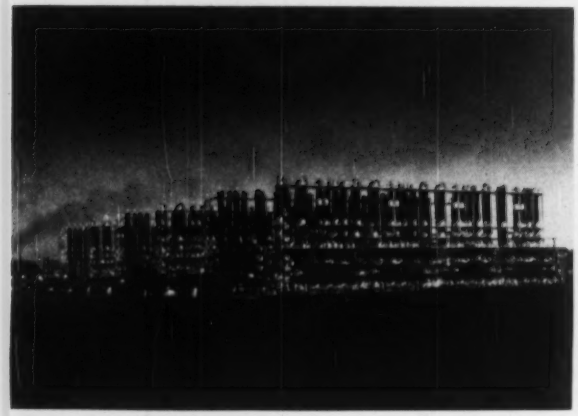
Fig. 5—Application of white polymer emulsion coating on glass foam insulation in cooler room

4. Insulation often requires surfacing to make its appearance uniform with the surroundings, so that special colors or textures sometimes are specified.

5. The physical limitations of surfacings must be considered in the design of an insulation system. Flammable surface coatings and mastics should not be used in construction where fire hazard cannot be tolerated. Temperature limits of surfacings, both high and low, must be observed. Possible attack of plastic foams by solvents in surfacings must also be considered.

6. The over-riding design factor with surfacings, as with many other items of building construction, is economy—economy in cost of surfacing material, cost of application, and most important, economy in service.

Fig. 6—Fire-resistive vapor barrier mastic surfacing over glass foam insulated towers used in heavy water separation at Atomic Energy Commission Plant



## Surfacing Materials and Installation

Insulation surfacings for fibrous-glass and foam thermal insulations do not differ in type substantially from those used for many years in the thermal insulation field. However, the composition and properties of modern surfacings are quite different. The surfacings available are mastics, which are relatively thick coatings; more liquid coatings, arbitrarily called surface coatings; and sheet materials, such as plastic films, sheet metal, paper, or laminated combinations. Woven fabrics such as cotton and glass are frequently used with surface coatings. Plaster, cement, and ceramic tile continue to supply surface protection for insulation, especially in refrigerated storage.

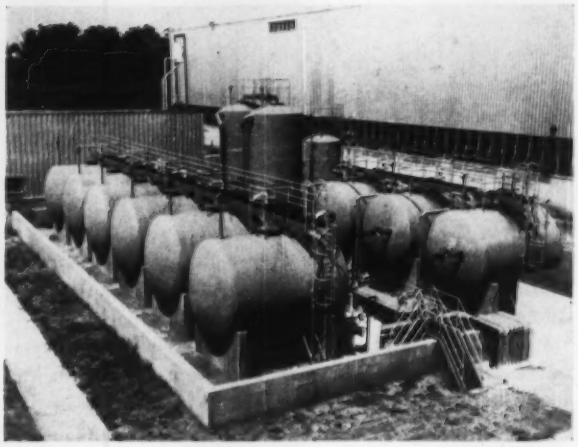


Fig. 7—Thermal insulation on piping and vessels surfaced with polymer emulsion coating in colors to fit plant decoration schedule

In *cold rooms*, rigid and semi-rigid block and sheet forms of fibrous glass, foamed glass, or foamed polystyrene are commonly used. Design considerations for surfacing are: protection from damage, sealing against air infiltration, appearance, and economy. Although cement, plaster, or ceramic tile are often used, the newer finish of hydraulic-setting cement and rubber latex is often specified, as is magnesium oxychloride plaster. These latter two provide a relatively hard yet tough finish, with good resistance to damage and good appearance. A more economical finish in cooler rooms is asphalt emulsion mastic finished with a white emulsion type surface coating as shown in

Fig. 5. For wall areas above the wainscoating in coolers, a single application of white emulsion surface coating is sometimes acceptable.

The design of surfacings for *piping and equipment* includes all of the considerations listed. Vapor barrier surfacing is required for the fibrous glass and for the permeable types of foam insulation in cold or dual-temperature service. Vapor barrier may be supplied by the insulation manufacturer as an integral jacket or a vapor barrier coating may be applied on the job. Jackets are usually laminated combinations of paper and aluminum foil, often creped and reinforced with sisal or glass thread to improve damage resistance. A vapor barrier adhesive must be used for cementing laps of this jacketing. Vapor barrier surface coatings are available where resistance to solvents or chemicals is required.

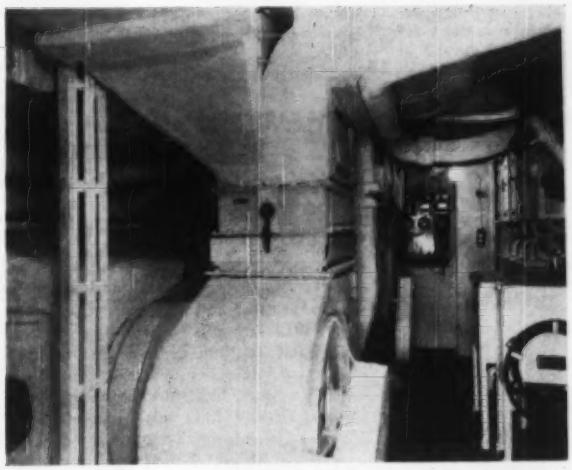


**Fig. 8—White fire-resistive polymer emulsion coating with fabric membrane as surfacing for fibrous glass insulation piping in ducts and fan housings aboard large passenger ship**

If exposed to weather paper jacketed piping is often protected with mastic coatings or roofing jacket. For cold vessels and equipment outdoors, economy favors surfacing with vapor barrier mastics alone, either the asphalt type or the fire resistive type now available with *Underwriters' Laboratories* listing. Fig. 6 shows glass foam insulated towers coated with fire-resistive vapor barrier mastic in the heavy-water separation area at an Atomic Energy Commission plant.

The non-permeable types of foam insulation do not require vapor barrier surfacing for normal service, but surfacings usually are applied for damage resistance, joint sealing, and for weatherproofing. For warm vessels and equipment outdoors, either aluminum jackets or emulsion mastic coatings are suitable, but pigmented polymer emulsions are gaining increased acceptance for this service. These emulsion coatings are available in many colors, they have low flame spread characteristics, they are suitable for indoor or outdoor service, and they afford economies of application. Fig. 7 shows a typical installation of insulated vessels and piping surfaced with colored insulation coating.

Surfacing for *cold air ducts* must have an acceptable vapor barrier rating, must be fire resistive and, where not concealed, must have good appearance and provide adequate damage resistance. Roof installations of insulated duct systems require protection from the weather. The same type of surfacing is also required for *warm air ducts*, including vapor barrier, where the duct system is used for alternate cooling or heating.

All surfacing used on duct insulation should be fire resistive. Insulation on the outside of the duct may be surfaced with laminated sheet materials, with all joints and laps vapor sealed. Whether outside or inside of the duct, insulation may be protected with fire resistive mastics or with fire resistive pigmented polymer emulsion coatings suitably reinforced with glass cloth membrane. Fig. 8 shows a portion of an air-conditioning duct system on a large ship. The insulation is surfaced with a fire resistive white emulsion coating reinforced with cloth membrane. Surfacings for fiber glass and foam insulations, therefore, are available to fit every design consideration. The choice of surfacings should be made with these factors in mind. Manufacturers of surfacings, as well as the insulation manufacturers, stand ready to supply detailed design information about surface treatments. Design engineers should consider carefully the limitations of each surfacing material offered, since no one surfacing is satisfactory for all insulation service conditions.

As newer insulations are developed and accepted, new materials and methods of surfacing will be available to insure satisfactory job performance.

**Acknowledgment**

The author is indebted to the following companies for the photographs which illustrate this article: Benjamin Foster Co., Wide World Photos, *National Fire Protection Association*, Pittsburgh-Corning Corp., U. S. Atomic Energy Commission and Ford Motor Co.

## HAINES ON EJC JOINT COMMITTEE

It has been announced that Past Pres. John E. Haines, Minneapolis, Minn., has been appointed as representative of the Society on the *EJC-AIA* Joint Committee.

## LOCKLIN JOINS BATTELLE STAFF

D. W. Locklin, Oakmont, Pa., has joined the staff of Battelle Memorial Institute at Columbus, Ohio. He plans to conduct research on thermal system and combustion and to devote attention to the subject of solar heating and heat storage. Mr. Locklin left the Timkin Division of Scaife Co. He was also a member of the staff of the Society Laboratory in Cleveland for several years before going to Oakmont. He is the

author of a number of technical papers and is at present time a member of the TAC on Combustion.

## HUNTER MADE *ASME* FELLOW

It has been announced that L. N. Hunter, Johnstown, Pa., past president of the Society, has been elected a fellow of *ASME*. The election is in recognition of his activities in *ASME* and his contributions to the profession.

Currently, Mr. Hunter is serving as a member of the ASHAE-*ASRE* Committee on Cooperation. Included also in his activities in connection with the Society is membership on the Exposition Committee, the Long Range Planning Committee, and the Nuclear Energy Committee.

## COUNCIL MEETS AT MILWAUKEE

Pres. E. R. Queer, University Park, Pa., presided at the regular spring meeting of the Council of the Society held on April 20 at the Hotel Schroeder in Milwaukee. Among the important actions taken during the course of the meeting were the following ones.

Authorization was given for the continuation of the Society cooperative research project on air cleaning at the University of Minnesota, and on noise in piping systems at Northwestern University. G. B. Supple, Indianapolis, Ind., was appointed for a 3-year term on the Charter and By-Laws Committee. Treas. J. H. Fox, Toronto, Ont., Canada, was appointed to the Public Relations Committee, and T. V. Johnson, Chicago, Ill., and A. C. Lagow, Austin, Tex., were appointed as Advisory Members of that same committee. Council confirmed the appointment of K. T. Davis, Syracuse, N. Y., for a one-year term on the Standards Committee. To serve on the ASHAE-*ASRE* Committee on Cooperation, the Council appointed W. G. Hole, Montreal, Que., Canada, and P. J. Marschall, Chicago, Ill.

The council also voted to approve publication of the *Rocky Mountainaire* by the Rocky Mountain Chapter, and to state the general retirement policy of the Society. It acted to confirm the nomination of Dr. N. B. Hutcheon, Ottawa, Ont., Canada, to the Office of International Critical Tables. To serve as the Society representative at the 1959 Nuclear Congress, W. F. Friend, New York, N. Y., was appointed. The Council also acted to formalize the wording of several proposed amendments to the By-Laws to be acted on at an early Meeting.

## GERMAN ENGINEERS AT CENTRAL OHIO AND WASHINGTON, D.C. CHAPTERS

A group of heating, ventilating and air-conditioning engineers from Germany were dinner guests at the Central Ohio Chapter at a meeting on May 28-29th. Arrangements were also made for them to visit Battelle Memorial Institute, Armstrong Furnace Co., Ohio Fuel Gas Co., and the Southern Ohio Electric Co. in Columbus.

On June 10, the group were guests of the Washington, D.C. Chapter where they participated in a tour of the heating and air-conditioning plant at the Pentagon Building.

## PAPERS FOR 1959 NUCLEAR CONGRESS

Preliminary plans for the Fifth Nuclear Congress to be held in Cleveland, Ohio in April 1959 have been announced by *Engineers Joint Council*. At the same time, any members of ASHAE who would like to present technical papers during the Congress were invited to submit outlines before October 1, 1958. Each prospective author should also submit a 300-500 word summary of the proposed paper sending the summary to the Headquarters office. It has been indicated that the papers to be selected for presentation will be those which deal with the most recent and outstanding developments in the nuclear field.

Topics in the past have included reactor design, power plants, radiation techniques, instrumentation, shielding, waste disposal and related items.

# HONORED BY LIFE MEMBERSHIP

*by recent action of the Society's Council*

W. M. Heebner

**Walter M. Heebner:** Teaneck, N. J. ««« Has been with Warren Webster & Co. of Camden, N. J., for 36 years and has been in the heating and engineering business since 1912. In 1955 he became district representative of the Newark, N. J., office of his company. ««« Was born in Pottsville, Pa., and has worked in Scranton, Boston, Detroit and New York. ««« Mr. Heebner joined the Society in 1922 and has been treasurer of the New York Chapter since 1932. He also belongs to the *National Society of Professional Engineers*.

# ACTIVITIES OF SOCIETY CHAPTERS

**The last Chapters Regional Committee Meeting for 1958 was held May 20, at the Hilton Hotel, Albuquerque, N. Mex. The ASHAE-*ASRE* merger plan and various ways to improve chapter operations were among numerous issues discussed. Many fine speakers also were heard during other regional meetings and the two-day meeting at Spokane, Wash., May 2-3, also featured technical talks. Meanwhile, chapters throughout the country heard a variety of interesting technical and non-technical talks.**

## REGIONAL COMMITTEE MEETINGS FOR REGIONS 4, 3, 7 and 6

Previous Regional Committee Meetings of Regions 1, 2, and 5, already have been reported in the JOURNAL. Later meetings were held by Regions 4, 3, 7 and 6. Excellent attendance was a feature at all of the meetings.

### Region 4 Committee Meeting

A two-day session featured the Chapters Regional Committee Meeting of Region 4, held May 2-3, at the Davenport Hotel, Spokane, Wash. The meeting was conducted by Regional Dir. W. O. Stewart. Society officers included Pres. E. R. Queer and 1st Vice Pres. A. J. Hess. Also in attendance was J. Donald Kroeker, Portland, Ore., who was introduced as the father of the Inland Empire Chapter which was the host chapter for the meeting. J. R. Morris was named secretary of the meeting.

The activities got off to a good start with a luncheon attended by more than 60 members and guests; a welcome was extended by *Miss Spokane*, dressed in Indian costume. Bruce Campbell was toastmaster. The luncheon speaker was 1st Vice President Hess, who discussed *Third Year of the Society's Regional Plan*. The first session was held on the afternoon of May 2. Welcome comments were made by Inland Empire Chapter Pres. J. A. Doyle and chapter agenda items were presented and discussed. A social hour preceded the dinner and President Queer gave a coffee talk on *General Conditions of the Society—Latest Developments of the* ASHAE-*ASRE Merger Plan*. This was followed by the Inland Empire Chapter Meeting at which Society officers, Council members, guests and host chapter officers were introduced. The dinner speaker was C. M. Wilson, general sales manager, Anemostat Corporation of America, New York, N.Y., who spoke on *High Velocity Air Distribution*. The second session on May 3, opened with a general discussion on chapter affairs having to do with im-

proved operations of chapters, including publications, dues structure, meetings, speakers, membership, etc.

L. E. Marque was named member to the 1959 Nominating Committee. W. Bruce Morrison was named first alternate and W. A. Biddle, second alternate. An invitation was extended by Golden Gate Chapter to hold the 1959 Regional Committee Meeting of Region 4 in San Francisco, and Puget Sound issued an invitation for the Regional Committee Meeting to be held in Seattle in 1960.

A luncheon followed with D. E. Arnold as toastmaster. Luncheon speaker Roy Rofinot, president of the Chamber of Commerce, discussed *Professional Responsibilities of the Society*.

The afternoon was devoted to technical sessions. *Weather Data* was discussed by W. J. Biggars. *Plutonium and Its Application* was discussed by Robert Fryar of General Electric Co. A social hour was followed by a banquet with George Schoen as toastmaster. The speaker was R. R. Lee of General Electric Co., who spoke on *Earth Satellites*. F. W. Jenkinson was general chairman of the meeting, assisted in various events by Max Tonn, W. F. Kelly, D. E. Arnold, S. A. Thomas, G. C. Murray, James Hutsinpiller, R. O. Haneberg and Ruth Marque.

## Region 3 Committee Meeting

More than 25 officers, members and alternates, and guests attended the Chapters Regional Committee Meeting of Region 3, held May 6 at the Le Claire Hotel, Moline, Ill. In attendance were Pres. E. R. Queer, 2nd Vice Pres. Walter A. Grant, Regional Dir. Fred Janssen and Asst. Secy. F. W. Hofmann, as well as guests from many of the chapters in the region.

The meeting was conducted by Regional Director Janssen. E. O. Hull was named secretary, assisted by Margaret Woodard, a professional stenographer. Welcome comments were given by W. W. Dodge, president of the host (Illinois-Iowa) chapter. The morning session was devoted to a discussion, led by President Queer, of the proposed ASHAE-*ASRE* Merger Plan, followed by various Chapter Agenda Items.

Following the luncheon, R. F. DeLay, Waldie and Briggs, Advertising Agency, discussed *Promoting Sale of Heating and Air Conditioning Products*.

**Head Table at Region 3 Chapters Regional Committee Meeting (*l. to r.*) *Seated:* Walter A. Grant, 2nd vice president; Fred Janssen, regional director; and E. R. Queer, president. *Standing:* W. W. Dodge, chapter president (Illinois-Iowa); D. H. Ninow, vice president.**

**Guests at Region 3 Chapters Regional Committee Meeting. (*l. to r.*) Seated: A. F. Hubbard, R. F. Demange, C. G. Tolson, J. R. Lewis, G. G. Partch. *Standing:* J. A. Sandberg, E. H. Belling, C. J. Regan, R. L. Graham, Art Thurman, L. A. Wilson, F. G. Baker, L. D. Thornton, H. M. Fitch, G. R. DeLay**

At an executive session in the afternoon, G. W. Myers of St. Louis was named as the Member of the Region 3 Nominating Committee. H. M. Fitch of Moline, Ill., was named First Alternate and W. A. Schworm of Ames, Ia., was named Second Alternate.

An invitation to hold the 1959 Chapters Regional Committee Meeting of Region 3 in St. Louis was extended by St. Louis Chapter, with an alternate invitation from Rocky Mountain Chapter to hold the meeting in Denver. The afternoon session also included discussion on matters having to do with improved operation of chapters, including publication, dues structure, meeting, speakers, membership, etc. A social hour followed at the Le Claire Hotel and dinner was served preceding the host chapter meeting. Dinner speaker was President Queer, who briefly discussed the merger plan and then gave

**Members, Alternates and Guests at Region 3 Chapters Regional Committee Meeting. (*l. to r.*) *Front:* D. H. Ninow, Illinois-Iowa Chapter; K. O. Williams and J. J. Blackmore, St. Louis Chapter; D. D. Pearsall, Rocky Mountain Chapter. *Center:* Fred Vogt and J. H. Jester, Minnesota Chapter; F. K. Ladewig and J. C. Fasnacht, Kansas City Chapter. *Rear:* W. A. Schworm and R. S. Stover, Iowa Chapter; W. W. Dodge, Illinois-Iowa Chapter; P. E. Chamberlin, Kansas City Chapter; A. S. Widdowfield, Rocky Mountain Chapter; and L. A. Heaven, Kansas City Chapter**

an illustrated talk on *Industrial Air-Conditioning of Underground Storage.*

The program for the meeting was planned by R. F. Demange, R. L. Graham and D. H. Ninow.

## Region 7 Committee Meeting

The Regional Committee Meeting of Region 7, was held at the Fort Garry Hotel, Winnipeg, Man., with the Manitoba Chapter acting as host. The meeting was conducted by W. G. Hole, regional director of Region 7. The group was welcomed to Winnipeg by Manitoba Chapter President, R. M. Fraser. Arthur de Breyne of Montreal Chapter was named secretary of the meeting. In attendance was E. R. Queer, University Park, Pa., Society president, but A. J. Hess, Los Angeles, Society 1st vice president was delayed by travel difficulties in reaching Winnipeg. The morning session was devoted to chapter agenda items and a discussion of the proposed ASHAE-*ASRE* merger plan, led by President Queer. Preliminary zoning for the proposed merged group would have split Canada and made various areas part of regions reaching up from the United States, but during a discussion of the proposed merger, a resolution was passed that in any possible rezoning involved as a result of the proposed merger, the Canadian chapters be included in an individual zone as at present.

President Queer was the luncheon speaker in place of 1st Vice President Hess and discussed general activities of ASHAE.

The afternoon session covered a general discussion on chapter operations, dues structure, meetings, speakers, membership and publications.

G. C. Davis, Manitoba Chapter, was named as the member of the Nominating Committee for 1959 of Region 7. G. N. Martin, Montreal Chapter was named first alternate and Jack Jenkinson, Ontario Chapter was named second alternate.

An invitation to hold the 1959 Chapters Regional Committee Meeting of Region 7, in Montreal, was extended by Montreal Chapter. A highlight of the meeting was a visit by the group to the Central Heating Power House, and a house party at the home of Mr. and Mrs. G. C. Davis. The group made the trip despite a bad blizzard and sub-degree temperatures.

A social hour preceeded the Manitoba Chapter Meeting and dinner. President Queer gave a coffee talk on *General Conditions of the Society—Latest Developments of the* ASHAE-*ASRE Merger Plan.* The dinner speaker was F. L. Jobin, Minister of Industry and Commerce, Province of Manitoba, who spoke on *Manitoba's Northland.* The program for the meeting was planned by A. H. Millar, R. M. Fraser and W. L. Algie.

*(l. to r.)* **W. G. Hole, regional director of Region 7, E. G. Queer, Society president, and R. M. Fraser, president of the Manitoba Chapter, in conversation before luncheon at Regional Committee Meeting**

**REGIONAL COMMITTEE MEETING**

**REGION 7**

**Winnipeg, Man., Canada**

*(l. to r.)* **R. A. Ritchie, alternate member, Chapters Regional Committee; John Thompson, member Chapters Regional Committee; E. R. Queer, president ASHAE, and F. W. Hofmann, assistant secretary**

*(l. to r.)* **W. L. Algie, Manitoba Chapter member; W. T. Atkinson, past president of Manitoba Chapter; Jean Veilleux, member of Chapters Regional Committee; Honorable Roger Teillet; and A. K. Piercy, alternate member on the Chapters Regional Committee**

*(l. to r.)* **G. C. Davis, named as member of Nominating Committee from Region 7 for 1959; John Thompson, member of Chapters Regional Committee; E. R. Queer, president of ASHAE; and R. A. Ritchie, alternate member of the Chapters Regional Committee**

## Region 6 Committee Meeting

The Chapters Regional Committee Meeting of Region 6 was held May 20, at the Hilton Hotel, Albuquerque, N. Mex. It was conducted by P. N. Vinther, regional director of Region 6. Welcome was extended by J. K. James, president of New Mexico Chapter, host chapter for the meeting. R. P. Lee, secretary of New Mexico Chapter was named secretary of the meeting. The morning program, which included a program for the ladies, was given over to a discussion of the proposed ASHAE-*ASRE* merger plan, and the presentation and review of chapter agenda items. The luncheon speaker was Dr. Wright Langham, medical research director, Los Alamos, New Mex., whose subject was *Radioactive Fallout.* At an executive session in the afternoon G. H. Meffert was named as the member of the 1959 Nominating Committee. F. R. Denham was named first alternate and J. S. Malahy, Jr., second alternate. An invitation was extended by Arkansas Chapter to hold the 1959 Regional Committee Meeting at Little Rock. Following the executive session, a general discussion was held on chapter publications, dues structure, meetings, speakers and membership. After a social hour, a dinner was held at the Fez. In a coffee talk, President Queer discussed general conditions of the Society and Vice President Hess spoke on *Third Year of the Society's Regional Plan.*

The New Mexico Chapter Meeting followed, after which President Queer gave an illustrated talk on *Industrial Air Conditioning of Underground Storage.*

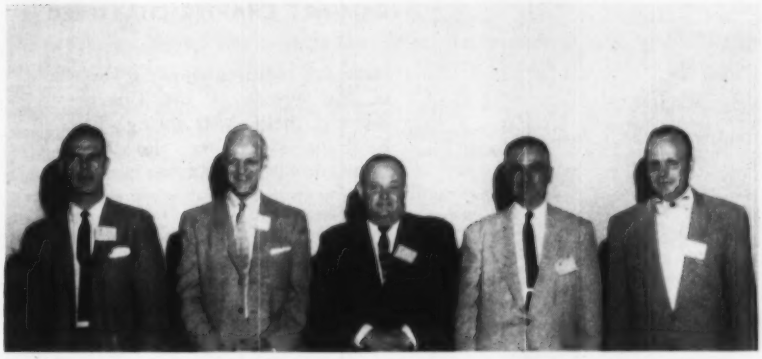
Host Chapter President James was general chairman of the meeting, assisted

by F. K. Bridgers, program chairman and W. L. Beale.

## Technical Talks

Members of ARKANSAS Chapter heard an informative talk by W. P. Glancy, Southwest district manager, Aerofin Corp., Dallas, Tex., who gave several examples of the psychrometrics of a chill water coil and discussed pros and cons of non-freeze coils and hot water coils for preheating. He also discussed the velocities of air over the face of coils, problems of reheat coils, roll control as compared to face control and illustrated various piping practices. A question and answer period followed. • • • A talk on *Comfort and Make-up Air for Industry* was heard by members of *BALTIMORE* Chapter. The speaker was K. E. Robinson, ventilation engineer, research staff, General Motors Corp., Detroit, Mich. • • • Gas burners and their application was the subject of a talk given before members of *BATON ROUGE* Chapter by G. C. Bergtholdt, assistant general manager and chief engineer, The Webster Engineering Co., Tulsa, Okla. • • • An enlightening talk on the *Electronic Air Cleaner Industry* was heard by members of *BRITISH COLUMBIA* Chapter recently. The speaker A. J. Evans, president and general manager of H. F. Clarke, Ltd., Vancouver, B.C., Canada, illustrated his talk with slides, movies and demonstration models, which covered the early history of air cleaners, their applications, uses and advantages. A movie made by chapter member H. E. McConaghy on a trip to Hawaii was shown. • • • M. J. Wilson, product specialist, Carrier Corporation, Syracuse, N. Y., presented an interesting paper on various types of air conditioning systems, for use in multi-story buildings, before 172 members and guests of *ILLINOIS* Chapter. The talk covered air water systems, air systems, water systems and the refrigeration system. Mr. Wilson's talk brought out that (1) low floor to ceiling heights and all glass buildings tend to make *air water* systems more favorable, (2) for old buildings where old heating equipment was antiquated, *air water* systems were quite popular, (3) where old buildings have vertical distribution of services, there is a tendancy to favor the *induction unit* type of air conditioning. Mr. Wilson showed various slides illustrating cost comparison of various systems. • • • Members of ILLINOIS-IOWA Chapter recently heard a talk on ventilation in connection with hygiene in industrial buildings. The speaker was W. R. Retzer, Caterpillar Tractor Co., Peoria, Ill. A lively discussion period followed. •

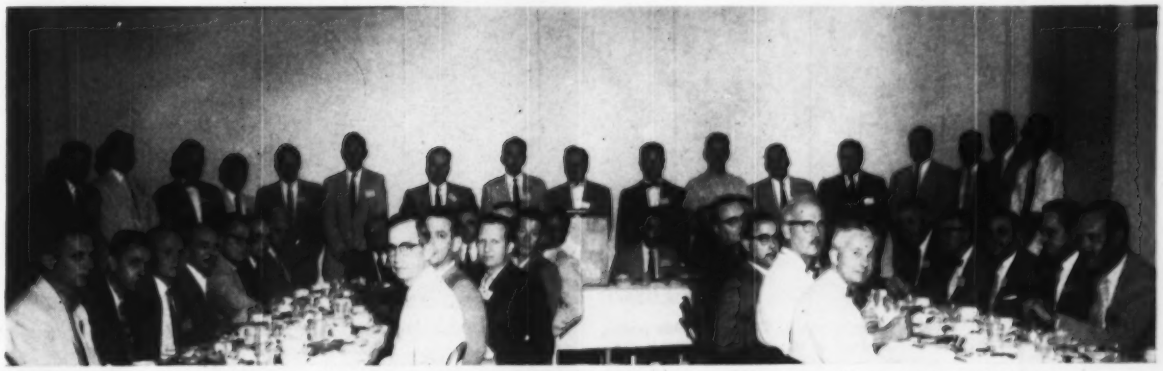
## REGIONAL COMMITTEE MEETING — ALBUQUERQUE, N.M.



**Society Officers and host chapter officers at Region 6 Chapters Regional Committee Meeting held at Albuquerque, N. Mex., May 20 (*l. to r.*) R. P. Lee, New Mexico chapter secretary; P. N. Vinther, regional director of Region 6; 1st Vice Pres., A. J. Hess, Pres. E. R. Queer and New Mexico Chapter President, J. K. James**

## JOURNAL SECTION

• • *An Analysis of Schoolhouse Air Conditioning, Heating and Ventilating* was discussed by S. W. Miller, Jr., John J. Nesbitt, Inc., Philadelphia, Pa., before members of JACKSONVILLE Chapter. • • • 97 members and guests of *KANSAS CITY* Chapter heard an interesting, illustrated talk on *The Air Around Us* by S. A. Gray, regional sales manager, commercial division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. • • • 30 members and 35 guests of *LONG ISLAND* Chapter recently enjoyed a tour of the International Arrivals Building, at Idlewild Airport. E. R. Franzette, aviation promotion representative, The Port of New York Authority, conducted the group through the park-like setting of the grounds to the main feature of the tour, the central heating and air conditioing plant for the entire airport. The group saw a display of 9 absorption water cooling machines, totaling 6300 tons of refrigeration, 4 high temperature water boilers, each with a capacity of 40 million Btu per hr delivering hot water at 400 deg, as well as pumps, controls, panels and other appurtenances required to operate and control an installation of this size. • • • The speaker at a meeting of *MASSACHUSETTS* Chapter was J. A. McKay, eastern regional sales manager, Owens-Corning Fiberglas Corp., New York, N. Y., who discussed *The Role of Heating and Air Conditioning Engineers in Up-Grading Modern Construction.* • • • Members of *MEMPHIS* Chapter enjoyed an informative talk recently by G. B. Ramsey, III, engineer, George Wilson Co., Memphis, Tenn., who discussed pump applications and misapplications, pump curves and fan curves. • • • An illustrated talk on *Selection and Application of Fans* was heard by members of *MINNESOTA* Chapter. The speaker was J. F. Tobin, manager, Midwest Division, American Blower Div., Chicago, Ill. A question and answer period followed. • • • W. B. Moses, Jr., Engineering Sales Co., New Orleans, La., discussed *Water Treatment* before members of MISSISSIPPI Chapter recently. • • • A dramatic, illustrated talk on



**Officers, Members and Guests at the luncheon meeting at the Hilton Hotel in Albuquerque in connection with the Chapters Regional Committee Meeting of Region 6**

# JOURNAL SECTION

*Atoms and Energy* was given before members of NEW MEXICO Chapter. Dr. Marvin Wyman, University of California, Los Alamos, N. Mex., made an excellent presentation using a film. • • • Members of *NORTHERN PIEDMONT* Chapter heard a talk on *Economics of Incremental Air Conditioning Systems for Multi-Story Buildings* recently. The speaker was E. M. Johnson, chief product application engineer, Air Conditioning Division, Remington Corp., Atlanta, Ga. • • • *NEW YORK* Chapter members heard an illustrated talk on new developments in hot water heating by H. A. Lockhart, vice president and chief engineer, Bell & Gossett Co., Morton Grove, Ill. Mr. Lockhart's talk produced a lively question and answer period. • • • A panel on *High Pressure vs. Low Pressure Air Distribution* was the feature of a recent meeting of *NORTHERN OHIO* Chapter. J. L. Frissee, The Thermal Products Co., Cleveland, Ohio, spoke on the advantages of high velocity systems, and L. C. Burkes, secretary, Slawson Equipment Co., Cleveland, Ohio, presented the advantages of low-velocity systems. H. W. Heisterkamp, Heisterkamp & de Fasselle, Cleveland, Ohio, acted as moderator of the panel. • • • Members of *OKLAHOMA* Chapter recently heard a discussion of Application Problems of Cooling Coils by W. P. Glancy, Southwest district manager, Aerofin Corp., Dallas, Tex. • • • An informative talk on *Motor Controls for the Heating and Air Conditioning Industry* was given before members and guests of *PITTSBURGH* Chapter. The speaker, Charles Hawks of the Allen-Bradley Co., Pittsburgh, Pa., explained simple motor controls and advanced to the more complicated controls, explaining how and where each should be used. • • • M. J. Brown, climatologist for the U. S. Weather Bureau, presented an index for determining and calculating fuel consumption before members of *UTAH* Chapter. Mr. Brown said there was quite a variance in the degree-days for Salt Lake City when using readings from the airport, which is approximately 4 miles west of the city, and those taken in Salt Lake City proper. Mr. Brown said he is working on a similar method for calculating operating costs of air conditioning systems. • • • The results of a commercial and industrial air conditioning survey was presented by members of the E. I. DuPont DeNemours & Co., at a meeting of *SOUTHERN CALIFORNIA* Chapter. The speakers were G. J. Roewe, Paul Dahlen and S. N. Seeley, all from DuPont's Freon Products Division, Palo Alto, Calif. The survey made it apparent that there is a vast, untapped, comfort-air-conditioning market available for a good salesmanship at all levels of the industry. • • • A discussion at which members wrote questions on slips of paper and passed them to the moderator, who in turn presented the questions to a panel was the feature of a recent meeting of *SOUTHERN PIEDMONT* Chapter. A. W. Bainbridge, Robt. E. Mason & Co., Charlotte, N. C. acted as moderator. The engineers were R. G. Agnew, Mechanical Engineers, Inc., Charlotte, N. C. and E. W. Bryan, Bryan Assocs., Charlotte, N. C. The questions and answers were enlightening and it was agreed unanimously by the members to hold more such programs as it made possible more member participation in chapter programs. • • • W. G. Martin, Jr., branch manager, Johnson Service Co., W. Hartford, Conn., gave an interesting, illustrated talk on *Volume Control in Low and High Velocity Systems* at a meeting of *WESTERN MICHIGAN* Chapter. A general discussion followed. • • • An informative and illustrated talk on the *Heat Pump Installation at the Sylvania Plant* was given by G. C. Briley, application engineer, York Corp., Rochester, N.Y.,

## CALGARY CHAPTER CHARTERED

Here are pictures showing some of the events at the Charter Meeting held last spring. For a fuller story see the June issue, JOURNAL SECTION, p. 170.

**(Left) A chuckwagon ride was given in traditional Western fashion. Seated beside the driver is Pres. E. R. Queer, while standing behind is W. G. Hole of Montreal, Regional Director for Region 7, and H. W. Klassen, incoming president of the Calgary Chapter. Cowboys at the rear include Calgarians G. H. "Curly" Galbraith, publicity chairman, Fred Thompson, a member of board of governors, and P. M. Meis, secretary**

***Seated (l. to r.)* Ray Laing, treasurer; L. D. Ontonio, vice president; H. W. Klassen, president; and P. M. Meis, secretary. *Standing:* E. W. Deeves and N. J. Howes, board of governors; F. W. Hofmann, assistant secretary of ASHAE; E. H. Watson and F. B. Thompson, board of governors**

**At Calgary Charter Meeting Edmonton members P. M. Butler, president of the Edmonton Chapter and A. N. Nordstrom (on the left) receive cowboy hat ash trays from Calgary's "Mayor" D. E. A. MacKay while the speaker of the evening, Ken Cutts, of the Canadian Bank of Commerce, look on**

**W. M. Heebner receives electric wrist watch from J. B. Hewett (standing), while Pres. C. R. Hiers looks on (center). Presentation was on occasion of Mr. Heebner's retirement from his 25 years of service as treasurer of the New York Chapter.**

**Retiring Pres. C. R. Hiers installs W. J. Olvany, Jr. as president of the New York Chapter. Mr. Olvany's father, the late W. J. Olvany was president of the New York Chapter in 1924.**

## QUARTER CENTURY TREASURER

before members of *WESTERN NEW YORK* Chapter. The meeting was preceded by a tour of the heat pump installation at the new Sylvania Research Building in Buffalo, N. Y.

### Non-Technical Talks

Members of *ILLINOIS* Chapter recently heard an interesting talk on professional baseball by Joe Heinsen of the Chicago White Sox. Mr. Heinsen also showed a film on the highlights of the 1957 World Series game. • • • Nathaniel Glickman, consulting physiologist, Miami Beach, Fla., recently gave a talk on *The Effects of Environmental Stress on the Human Body* before members of *JACKSONVILLE* Chapter. Dr. Glickman also answered questions on the subject and gave a brief outline on the work the ASHAE Laboratory has planned for the future. • • • *The Role of Economics in the Home Building Business with Particular Emphasis on Current Economic Conditions* was the subject of a talk before *JOHNSTOWN* Chapter members. The speaker was N. H. Rogg, chief economist of the *National Association of Home Builders*, Washington, D. C. Mr. Rogg stated that the future of home building is good, but that the industry was feeling the effects of transition to a reduced rate of activity, which is expected to continue for some time. Recent loosening of credit restrictions is expected to increase the demand for housing, Mr. Rogg said, but declared that the housing industry should do more to create a desire for new housing through more effective merchandising. Discussion followed. • • • An inspection trip of Ballentine's Brewery, Newark, N. J., was enjoyed by members of *NORTH JERSEY* Chapter recently. The group inspected mechanical equipment, piping, refrigeration, pumping, etc. Refreshments were served. • • • *The Man With the Gray Flannel Brain* was the subject of a talk before members of *ONTARIO* Chapter. The speaker was K. E. Gould, associate publisher and editor, Age Publications, Ltd., Toronto, Ont., Can., whose address dealt with advertising in the air conditioning industry. The chapter reported that Mr. Gould's talk stimulated more controversy and discussion than any it had had for several years. The question period brought forth many suggestions as to how the industry could improve on advertising and raise the level of domestic heating. • • • Members of *SOUTH CAROLINA* Chapter heard an informative talk on the recently adopted Columbia Bid Registry Plan by W. O. Blackstone, W. O. Blackstone & Co., Inc., Columbia, S. C. A lively question and answer period followed. • • • Several of the projects under way at the ASHAE Laboratory, at Cleveland were discussed by B. H. Jennings, director of research, ASHAE Research Laboratory, Cleveland, Ohio, at a recent meeting of *TOLEDO* Chapter. Mr. Jennings discussed funds allocated to research and told the group about the solar calorimeter test, the proposed restudy of the comfort chart and the effect of environment on productivity as well as on learning. He discussed the odor studies being undertaken, studies on panel cooling to reduce lighting load, sound measurement of fan output and the current study on sound in Navy elbows. Mr. Jennings also discussed cooperative research programs, such as the sound of combustion in heating units undertaken at Battelle, the solar collector studies at the University of Minnesota, as well as sound in water systems conducted at Northwestern. A question and answer period followed Mr. Jennings' presentation. • • • Members of WESTERN NEW YORK Chapter recently heard F. H. Faust, manager product planning, General Electric Co., Bloomfield, N. J. and regional director of Region 1, give an enlightening talk concerning current activities of the Society and the proposed merger of ASHAE and *ASRE*. Following his talk, Regional Director Faust answered many questions from the floor.

**Jay Dee Faris, winner of this year's W. T. Miller Award, shows the plaque to Robert J. Ladner and C. Dale Robinson; both received honorable mention**

## ANNUAL W. T. MILLER AWARD

Jay Dee Faris, Vincennes, Ind., senior in the School of Mechanical Engineering, Purdue University, was the recipient of the 1958 W. T. Miller award. The award, named in honor of Prof. W. T. Miller, was established by the Indiana Chapter of the Society to strengthen the Purdue Student Branch, and to create a greater interest among students in the fields of heating and air conditioning.

The award consists of a permanent plaque, hung in the Mechanical Engineering Building, with the recipient's name added each year. Mr. Faris also received a collection of the best books in the field of air conditioning, a library of 15 volumes valued at approximately $100.

Honorable mention was given to C. Dale Robinson, Bedford, Ind., and Robert J. Ladner, Chicago, Ill., both seniors. Each of these students received books valued at approximately $80.

The recipient of the award is selected by a committee of the Indiana Chapter, and is based on the activity participation of the Student Branch members. The com-

# JOURNAL SECTION

mittee interviews the 3 students with the highest number of activity points, and selects the recipient of the award. Activity points are accumulated during the year by registering in one or more air-conditioning courses, on being an officer or participating in committtee work, by attending Student Branch meetings or joint meetings with the Indiana Chapter, by participating in field inspection trips, and by signing new members.

Prof. F. B. Morse, faculty advisor of the Purdue Student Branch, reports considerable interest in the award by mechanical engineering students.

## CANDIDATES FOR MEMBERSHIP

**Listed here are the names of 84 men who are the candidates for membership or advancement in membership grade. Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before July 31, 1958, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.**

*Note:* **Advancement* †*Reinstatement*

### Arkansas (*Region* 6)

LEMKE, RAYMOND, Sales Engr., Minneapolis-Honeywell Regulator Co., Little Rock.

### California (*Region* 4)

ARONOFF, D. J., Partner, Ackerman & Aronoff, Palo Alto.

CAPITOLO, J. C., Sales Engr., Johns-Manville Sales Co., San Francisco.

CAVANAGH, P. L., Mech. Engr., Mare Island Naval Shipyard, Vallejo.

GOLESTAN, BOLAND, Design Engr., Deutsch Fastner Co., Los Angeles.

JORGENSON, S. R., Design Engr., Standard Oil Co. of California, San Francisco.

LOBER, ALLEN, Mech. Engr., Hellman & Lober, Los Angeles.

MCCUMBER, WILLIAM, Mgr., San Francisco, L. J. Prues & Associates, San Francisco.

MONTGOMERY, R. D., Partner, Montgomery & Davis, El Cerrito.

SUDA, M. N., Assoc., G. L. Gendler & Associates, Berkely.

WYSOCKI, JERZY*, Sr. Designing Engr., A. C. Martin & Assoc., Los Angeles.

### District of Columbia (*Region* 5)

GOVAN, F. A., Staff Engr., National Academy of Science, Washington.

### Illinois (*Region* 2)

ENOCHS, W. F., Repr., Burnham Corp., Chicago.

### Indiana (*Region* 2)

CHAPMAN, J. F., JR., Cons. Engr., New Haven.

UEBER, J. D., Tech. Service Dir., American Rock Wool Corp., Wasbash.

### Iowa (*Region* 3)

DICKINSON, E. W., Sales Engr., The Powers Regulator Co., Des Moines.

### Kentucky (*Region* 5)

HARAGAN, R. M., Assoc., H. M. Lutes & Associates, Louisville.

WEBB, E. M., Sales Engr., Dura-Vent Corp., Louisville.

### Louisiana (*Region* 5)

MAKOFSKY, EDWARD, JR., Repr., Southern Heater Co., New Orleans.

SCHULZE, K. P.*, Sales Engr., Industries Sales Corp., New Orleans.

### Maryland (*Region* 5)

PUTMAN, D. H., Second Lieutenant, U. S. Army Ordnance Corps, Aberdeen Proving Ground.

### Massachusetts (*Region* 1)

CRAMER, H. L., Pres., H. Leslie Cramer Co., Inc., Needham.

JONES, W. C., Mgr. Dvlpt., Engrg. Section, Westinghouse Electric Corp., Sturtevant Div., Hyde Park.

WASON, A. B., Div. Appl. Cons., Westinghouse Electric Corp., Sturtevant Div., Hyde Park.

YOURELL, W. J., Htg. Engr., Uhl, Hall & Rich, Boston.

### Michigan (*Region* 2)

ADAMS, J. C., Sales Engr., Saunders & Co., Detroit.

CURTIS, S. R.*, Sr. Proj. Dvlpt. & Research Engr., Motor Wheel Corp.-Duo Therm Div., Lansing.

NAMBIAR, T. P. G., Trainee, Sales Engrg., Foreign Division, American-Standard, Detroit.

REESE, D. G., Sales Engr., Acme Service & Supply Co., Muskogee.

SCHEFF, E. C., Engrg. Designer, Robert G. Caughey, Cons. Engr., Ferndale.

STEEN, C. O., Sales Engr., National-U.S. Radiator Corp., Detroit.

### Minnesota (*Region* 3)

ADAMSON, R. R., Sales Engr., American Blower Div., American-Standard, Minneapolis.

ANDERSON, H. C., Sales Mgr., Jay Distributing Co., Minneapolis.

### Missouri (*Region* 3)

JENKINS, W. J., Contractor, Frigid Sales & Service Corp., St. Louis.

SONTAG, F. A., Engr., Elus Corp., Kansas City.

### New Jersey (*Region* 1)

AUCHMOODY, F. W., Proj. Engr., Nicholas Schwalje, Inc., Metuchen.

GROSSMAN, BERNARD, Owner, Jed Distributing Co., Caldwell Township.

MITCHELL, R. T., Sales Engr., John B. Hewett Co., Inc., Union.

### New Mexico (*Region* 6)

PARKER, J. J., Sales Repr., Technical Service Co., Albuquerque.

### New York (*Region* 1)

ANZALONE, P. G., Sales Engr., Todd Shipyards Corp., Brooklyn.

BAAN, G. B.†, Marketing Coordinator, Standard Oil Co. of N. J., New York.

BERGMAN, JOSEPH, Mgr., Wholesale Distributors, Inc., Jamaica.

BERNARD, G. M., Asst. Squad Leader, The Anaconda Co., New York.

FISHER, R. E., Assoc. Editor, Engrg. *Architectural Record* (F. W. Dodge Corp.), New York.

MCCREARY, D. A.†, Gen. Mgr., C. R. Joyce & Son, Albany.

PEKELNEY, ALBERT, Pres., Altherm Inc., New York.

TAYLOR, MORTON, Draftsman Supvsr., Contractors Sheet Metal Inc., Brooklyn.

STEENECK, K. C.†, Dist. Repr., Warren Webster & Co., New York.

VOISINET, J. R., Sales Engr., Weber, Loes, Weber Associates, Inc., Buffalo.

WANG, E. D., Design Engr., Sargent, Webster, Crenshaw & Folley, Syracuse.

### North Carolina (*Region* 5)

SCRUGGS, C. E., Tech., Johnson Service Co., Greensboro.

SWAIM, J. H., Sales Engr., Johnson Service Co., Greensboro.

### Ohio (*Region* 2)

DOVALA, A. P., Repr., Air-Maze Corp., Cleveland.

FRISINA, F. R., Sales Repr., Cleveland Electric Illuminating Co., Cleveland.

HAAK, C. E.*, Draftsman, Fulton & Dela Motte & Assoc., Cleveland.

HICKEY, J. M., Vice Pres., Crysler Sales, Cleveland.

JOHNSON, R. A., Dist. Mgr., Engrg. Mach., York Corp., Cleveland.

MEYER, C. H., Sr. Proj. Engr., Air-Maze Corp., Cleveland.

### Oklahoma (*Region* 6)

SOUTHARD, E. G., Bldg. Supt., Seismograph Service Corp., Tulsa.

### Oregon (*Region* 4)

FARNES, R. G., Repr., Bert Farnes Co., Portland.

### Pennsylvania (*Region* 1)

CRAIG, J. E., Mgr., Packaged A-C Sales, National-U.S. Radiator Corp., Johnstown.

GOODWIN, H. H., Br. Mgr., Barber Colman Co., Philadelphia.

HARTMAN, D. P., Sales Engr., W. J. Keist & Son, Inc., Pittsburgh.

MCKINLEY, J. R., Chief Engr., A. Ernest D'Ambley, Philadelphia.

WAGNER, B. C., Cons. Engr., Wyomissing.

### South Carolina (*Region* 5)

CREWZ, J. M., Engr.-Power, E. I. du Pont de Nemours & Co., Camden.

### Tennessee (*Region* 5)

BARKSDALE, A. L., Mgr., Service & Installation, Minneapolis-Honeywell Regulator Co., Memphis.

### Texas (*Region* 6)

DUNN, H. F., JR., Sales Engr., Toole & Cunningham, Houston.

KEMPEN, E. P., Mgr., Power Apparatus Sales, Graybar Electric, Co., Houston.

### Utah (*Region* 4)

TENNEY, R. L., Sales Engr., Specialty Sales Co., Salt Lake City.

### Wisconsin (*Region* 2)

EICHMAN, R. D., Sales Engr., Penn Controls Inc., Milwaukee.

SYLVESTER, G. C., Chief Prod. Engr., Carnes Corp., Verona.

### Canada (*Region* 7)

BURNS, A. G., Br. Mgr., J. P. Stephenson, Ltd., Calgary, Alta.

CONNOLLY, H. A., Chief Draftsman, A. C. Milroy & Associates, Ltd., Calgary, Alta.

KNAUD, J. J., Mech. Engr., Air Installations Dept., H.Q. A.D.C. Det #1, U.S.A.F., Ottawa, Ont.

LEITCH, D. T., Repr., Patricia Engineering, Winnipeg, Man.

PEDERSEN, M. V., Mech. Design Engr., Haddin, Davis & Brown Ltd., Calgary, Alta.

SCHWARTZ, MAURICE, Pres., Rideau Aluminum & Steels Ltd., Ottawa, Ont.

VILLENEUVE, A. V., Owner, New City Heating & Air Conditioning, Toronto, Ont.

WILSON, A. G., Asst. Mgr., Thermotank (Canada) Ltd., Montreal, Que.

**India**

AHUJA, I. M., Tech. Sales Engr., Forbes Forbes Campbell & Co. (Pvt.) Ltd., Bombay.

**Iran**

ARJOMAND, ESKANDAR, Tech. Mgr., Sho'leh Khavar Co., Ltd., Tehran.

**Mexico**

VARGAS, J. R., Mgr. A-C. Dept., Hubard & Bourlon Sucs S.A., Mexico City.

**Southern Rhodesia**

HURST, K. A., Sr. Design Engr., Brian Colquhoun & Partners (Rhodesia) Ltd., Salisbury.



## OBITUARIES

### JOSEPH BASTOW, JR.
**Pittsburgh, Pa.**

Joseph Bastow, Jr., 52, superintendent engineer for Charles A. Reiter Co., died suddenly this spring. Mr. Bastow had attended Carnegie Institute of Technology. He had been in the sheet metal business, design and supervision, since 1936, and had been responsible for the supervision and installation of sheet metal for Westinghouse Atomic Division's Bettes Airport, University of Pittsburgh's School of Engineering and Mines and Student Union and the Bell Telephone Western Headquarters Building.

### HENRY WILLIAM DIRKS
**Toledo, Ohio**

Henry William Dirks, 62, who joined the Society in 1953, died on May 5th. He was manager of the Mechanical Department of the Amstan Supply Division of the American Radiator and Sanitary Corp. He had been associated with the heating industry for 45 years and was honored last year by the Toledo Chapter for his service and guidance during its formative years.

He is known for his work in designing numerous schools, hospitals and churches in and around the Ohio area; and, specifically; for the Tiffin Dairy Plant, the Electrolite Plant and the National Housing Project in Toledo.

### H. PRESTON MOREHOUSE
**Newark, N. J.**

H. Preston Morehouse, 59, a member of the Society since 1933, died on April 23rd. He was employed by the Public Service Co. of New Jersey from 1922 until his death; he specialized in house heating and air conditioning and was assistant sales manager in the gas division at the time of his death.

Mr. Morehouse was born in Amenia, N.Y., and attended Rensselaer Polytechnic Institute where he received an E.E. degree in 1922.

After belonging to the New York Chapter of ASHAE for some years, Mr. Morehouse helped to organize the North Jersey Chapter, which was chartered in 1952. In 1953 he was awarded the *American Gas Association's* Distinguished Service Award for initiating and directing work on 2 reference manuals on gas heating.

He is survived by his wife and 2 sons.

### JEFF DAVIS OWEN
**Downey, Calif.**

Jeff Davis Owen, 65, construction engineer on numerous large buildings in southern California, died this spring. He had been in the heating and engineering field since 1914 and became a member of ASHAE in 1937. During World War II he was head operating engineer for the U.S. Army at March Field, Calif.

Mr. Owen was born in Athens, Tex., and supervised work in several western states at various times. He is survived by his wife, Ethel.

### ALEXANDER PIRRIE
**Toronto, Ont., Canada**

Alexander Pirrie, 52, vice-president of American-Standard Products Ltd. of Canada for the past three years, died suddenly May 22nd.

Mr. Pirrie was a member of the Ontario Chapter. Also, he was chairman of the educational committee for Ontario and a director of the *Foundrymen's Society*. He had just finished attending their convention, in Cleveland, and with his wife, Mary, was preparing to return home.

Besides his wife, the former Mary Cooper of Montreal, he leaves his daughters Sandra and Judy; and two sisters.

### C. WESLEY POTTER
**Lead, S. D.**

C. Wesley Potter, 56, a mine ventilation engineer for the gold mining concern of Homestake Mining Co., died on April 9. He had been a member of the Society since 1949. He was a graduate of the South Dakota State School of Mines and Technology, with a B.S. and an M.S. in Chemical Engineering. His work included research into the sources of airborne dust and the design and installation of mine ventilation equipment. He is survived by his wife.

### CHARLES A. REIF
**Buffalo, New York**

Col. Charles A. Reif, 67, board chairman of Reif Electronics, Inc., suffered a fatal heart attack on May 25. He was driving to his home at 77 Ruskin Rd., Eggertsville, after playing golf. He had been a member of the Western New York Chapter since 1936.

Colonel Reif served nearly 40 years in the Regular Army and various State Guard units. He founded the Reif-Rexoil Co., in 1924. He helped design a heating unit marketed by the company. He retired as president in 1956, continuing as a director and board chairman.

Although retired, Colonel Reif was Western New York distributor for Gulton Industries of Metuchen, N. J., and was a representative of Bache & Co., investment brokers.

Colonel Reif was a member of the Buffalo Chamber of Commerce. A 32nd degree Mason, he was a member of Highland Lodge 825, F&AM; Amherst Shrine Club of Ismailia Temple, AAONMS; the National Sojourners and Ancient Accepted Scottish Rite.

Surviving are his wife, a daughter, Mrs. David E. Bond of Seaford, Del., his brother Brig.-Gen. Allan F. Reif of Ft. Lauderdale, Fla., and three grandchildren.

### ARTHUR RITTER
**Scarsdale, N. Y.**

Arthur Ritter, 77, a member of the Society since 1911 and a Charter Member of the New York Chapter, died on May 5th. Mr. Ritter was with the American Blower Corp. from 1902 until his retirement in 1952. He acted as a draftsman and later, in the sales department, was a branch manager, district manager, manager of the export department, and an officer and director of his company. After his retirement he became a consulting engineer.

Mr. Ritter was born in Brooklyn, N.Y., and received a B.S. from the School of Science and Technology, Pratt Institute, in 1901. After joining the Society he was treasurer of the New York Chapter, 1911-15, vice-president, 1915-16, and president, 1916-17. In 1948 he was elected a Life Member of the Society.

Mr. Ritter is survived by his wife, Aimee; a daughter and a granddaughter.

### IRWIN D. SHEA
**Los Angeles, Calif.**

Irwin D. Shea, 31, who joined the Society as a Junior Member in 1950, died this year. He was born in Chicago, Ill., and in 1945 received a B.E. in Mechanical Engineering from the University of Southern California.

He had been with the Bechtel Corp. for several years, but at the time of his death he was an engineer in the Atomics International Division of North American Aviation. He is survived by his wife, a daughter and a son.

# AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

**Headquarters Office**
62 Worth St., New York 13, N. Y.
Tel: BArclay 7-6262

(For names of Society Officers see p. 111)

**Research Laboratory**
7218 Euclid Ave., Cleveland 3, Ohio
Tel: UTah 1-6161

## Council and Council Committees

**Three Years:** F. H. Faust, Fred Janssen, J. W. May, G. B. Priester.

**Two Years:** W. G. Hole, P. J. Marschall, W. O. Stewart, P. N. Vinther.

**One Year:** A. B. Algren, John Everetts, Jr., P. B. Gordon, J. N. Livermore, J. H. Ross.

**Executive:** A. J. Hess, Chairman; J. H. Fox, P. B. Gordon, Walter A. Grant, E. R. Queer.

**Finance:** J. N. Livermore, Chairman; John Everetts, Jr., F. H. Faust, P. J. Marschall, J. H. Fox (Ex Officio).

**Membership:** J. H. Ross, Chairman; A. B. Algren, F. H. Bridgers, Fred Janssen, W. O. Stewart.

**Program and Papers:** John Everetts, Jr., Chairman; W. G. Hole, J. W. May, G. B. Priester, P. N. Vinther.

**Regions Central:** Walter A. Grant, Chairman; F. H. Faust (1); P. J. Marschall (2); Fred Janssen (3); W. O. Stewart (4); J. W. May (5); P. N. Vinther (6); W. G. Hole (7).

**Advisory Board** {P. B. Gordon, Chairman; Lester T. Avery, M. F. Blankin, S. E. Dibble, S. H. Downs, E. O. Eastwood, W. L. Fleisher, H. P. Gant, H. M. Hart, John E. Haines, C. V. Haynes, L. N. Hunter, John W. James, Samuel R. Lewis, Alfred J. Offner, F. B. Rowley, L. E. Seeley, A. E. Stacey, Jr., Reg. F. Taylor, G. L. Tuve, and A. C. Willard.

## General Committees

**Admission & Advancement:** Roswell Farnham, Chairman (one year); C. S. Koehler (two years); P. R. Achenbach (three years).

**Publication:** J. W. May, Chairman (one year); H. M. Hendrickson (two years); W. L. Ross (three years).

**Chapters Regional Committees:** The latest listing of members and alternate members for the 7 Chapters Regional Committees appeared in the May 1958 JOURNAL SECTION, p. 194.

**Charter & By-Laws:** J. C. Fitts, Chairman (one year); J. S. Locke (two years); G. B. Supple (three years).

**F. Paul Anderson (Honors & Awards):** A. J. Hess, Chairman; John W. James, C. H. Pesterfield, N. H. Peterson, R. A. Sherman, E. F. Snyder, Jr. (Ex Officio).

**Guide:** H. W. Alyea, Chairman; W. P. Chapman, R. C. Chewning, J. R. Duncan, R. A. Gonzalez, N. B. Hutcheon, M. W. Keyes, R. L. Maher, D. W. Nelson, E. F. Snyder, Jr. (Ex Officio).

**Committee on Research:** E. F. Snyder, Jr., Chairman; R. C. Jordan, Vice Chairman.

**Three Years:** P. R. Achenbach, S. F. Gilman, N. B. Hutcheon, R. M. Stern, H. E. Ziel.

**Two Years:** D. D'Eustachio, E. S. Howarth, H. R. Limbacher, E. F. Snyder, Jr., J. I. Trimble.

**One Year:** Albert Giannini, F. K. Hick, M.D., R. C. Jordan, H. A. Lockhart, Arthur Nutting.

**Research Executive:** E. F. Snyder, Jr., Chairman; R. C. Jordan, Vice Chairman; D. D'Eustachio, N. B. Hutcheon, H. A. Lockhart.

**Technical Advisory Committees:** These are subcommittees of the Committee on Research. The 1958 personnel appeared in the June 1958 JOURNAL SECTION, p. 174

**Long-Range Research Program Committee:** R. C. Jordan, Chairman; H. A. Lockhart, Vice Chairman, N. B. Hutcheon, Arthur Nutting, J. I. Trimble.

**Public Relations:** E. K. Wagner, Chairman; T. V. Johnson and A. C. Lagow, Advisory Members; E. J. Morris, R. S. Stover, J. H. Fox.

**Standards:** P. N. Vinther, Chairman; A. B. Algren; K. T. Davis; Albert Giannini; Fred Janssen; G. B. Priester.

**Standards Projects Committees:** These are established by Standards Committee as needed. The 1958 personnel is scheduled to appear in August JOURNAL.

## Special Committees

**ASHAE-AIA Committee on Cooperation:** John E. Haines, Co-Chairman; ASHAE Representatives — John Everetts, Jr., H. C. Hoffman, G. A. Linskie, R. J. Salinger. **AIA** Representatives — Angelo R. Clas, Co-Chairman; S. T. Franklin, Sr., George S. Idell, R. E. Langdon, Jr., James B. Newman.

**ASHAE-ASRE Committee on Cooperation:** ASHAE Representatives — C. B. Gamble, W. G. Hole, L. N. Hunter, P. J. Marschall, E. R. Queer. **ASRE** Representatives — A. J. Hess, Chairman; Cecil Boling, E. H. Johnson, H. F. Spoehrer, F. L. Tarleton.

**NRC-National Academy of Sciences, Div. of Engrg.:** John W. James.

**Building:** P. J. Marschall, Chairman; Lester T. Avery, M. F. Blankin, C. R. Gardner, J. N. Livermore, R. A. Sherman.

**Educational Committee:** John W. James, Chairman; F. H. Buzzard, P. B. Gordon.

**EJC Representatives:** P. B. Gordon, A. J. Hess (Alternate), E. R. Queer (Ex Officio).

**Exposition:** L. N. Hunter, Chairman; P. B. Gordon, W. A. Grant, J. W. James.

**Joint ASHAE-ASAE Committee on Environment Studies:** ASHAE Representatives — A. B. Algren, M. K. Fahnestock, A. J. Hess, H. A. Lockhart, H. E. Ziel.

**AAAS Representative:** Walter A. Grant.

**Long-Range Planning:** L. N. Hunter, Chairman (one year); John Everetts, Jr. (one year); J. W. James, J. D. Kroeker (two years); P. B. Gordon, John E. Haines (three years).

**Nuclear Energy Engineering:** W. F. Friend, Chairman; L. N. Hunter, R. A. Sherman, E. F. Snyder, Jr. (Committee on Research).

**Publication Advisory:** F. H. Faust, Chairman; R. E. Cherne, E. L. Crosby, J. C. Fitts, G. R. Munger, G. B. Priester.

**U. S. National Committee of International Institute of Refrigeration:** A. J. Hess, ASHAE Representative.

## Nominating Committee

| Region | Member | First Alternate | Second Alternate | |
|---|---|---|---|---|
| 1 | W. C. Kruse, Jr. | E. K. Wagner | L. A. Childs | |
| 2 | John Richmond | D. S. Falk | B. M. Kluge | |
| 3 | D. M. Allen | | G. W. F. Myers | Names designated by asterisk (*) selected by the Council; others selected by Chapters Regional Committees. |
| 4 | J. E. Murray | L. A. O'Meara | R. M. Stern | |
| 5 | R. O. McGary | R. K. Rouse | W. G. Robertson, Jr. | |
| 6 | G. H. Meffert | J. S. Malahy, Jr. | F. R. Denham | |
| 7 | D. W. Thomson | | | |
| 2 | A. W. Edwards* | | | |
| 3 | B. L. Evans* | N. H. Peterson* (4) | E. J. Morris* (5) | |
| 1 | H. L. Martin* | | | |
| 7 | H. R. Roth* | | | |

## Society Organization Personnel

**General Committees:** The By-Laws provide for 9 such committees. The latest list appears in this issue (see above).

**Research Committees:** The research program is under the guidance of the Committee on Research — a General Committee. The Committee on Research (see above) appoints Technical Advisory Committees as needed. The 1958 personnel appears in the June 1958 JOURNAL SECTION on page ..... 174

**Special Committees:** At present there are 9 of these committees. The latest listing appears in this issue (see above).

**Nominating Committee:** This committee's membership is fixed by the By-Laws. The latest listing appears in this issue (see above).

**Society Regional Organization:** The 1958 listing of the names of the Regional Directors and of the members of the Chapters Regional Committees was published in the May 1958 issue on page ..... 194

**Society Chapters and Branches:** The Society has chartered 72 Chapters, 1 Overseas Branch, and 6 Student Branches. These groups elect their officers and governing boards. A list of the presidents and secretaries was published in the May 1958 issue on pages ..... 195-196

## New York Coliseum

This $35 million structure has a 26 story office building, a large underground garage, and a 9 acre four level exhibition area with the most modern facilities obtainable.

**Exposition Capital of the World**

New landmark dominates Columbus Circle

OWNER
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Versatility of Powers Control meets the varied needs of this unique building. A million visitors and exhibitors annually will enjoy its air-conditioned comfort.

Ten cooling towers on the Coliseum roof provide condenser cooling water for 4100 tons of refrigeration. Four centrifugal compressors carry the cooling load. Interconnection of the cooling and chilled water circuits permits compressors to serve either the offices or Coliseum.

The large Coliseum areas are supplied by high velocity single zone air systems while the small meeting rooms, office areas, etc. are served by low pressure fan units and by high velocity double duct systems. One of the 7 Powers Control panels is shown above.

In the office building, occupants can dial the temperature they wish. Individual space control is obtained with 550 Powers Heating-Cooling Thermostats regulating 1400 unit air-conditioner valves. Interior zones are served by high velocity air systems.

**Consult Powers** when you have a temperature or humidity control problem for a new or existing building. You can benefit from our 65 years of experience gained in all types of buildings.

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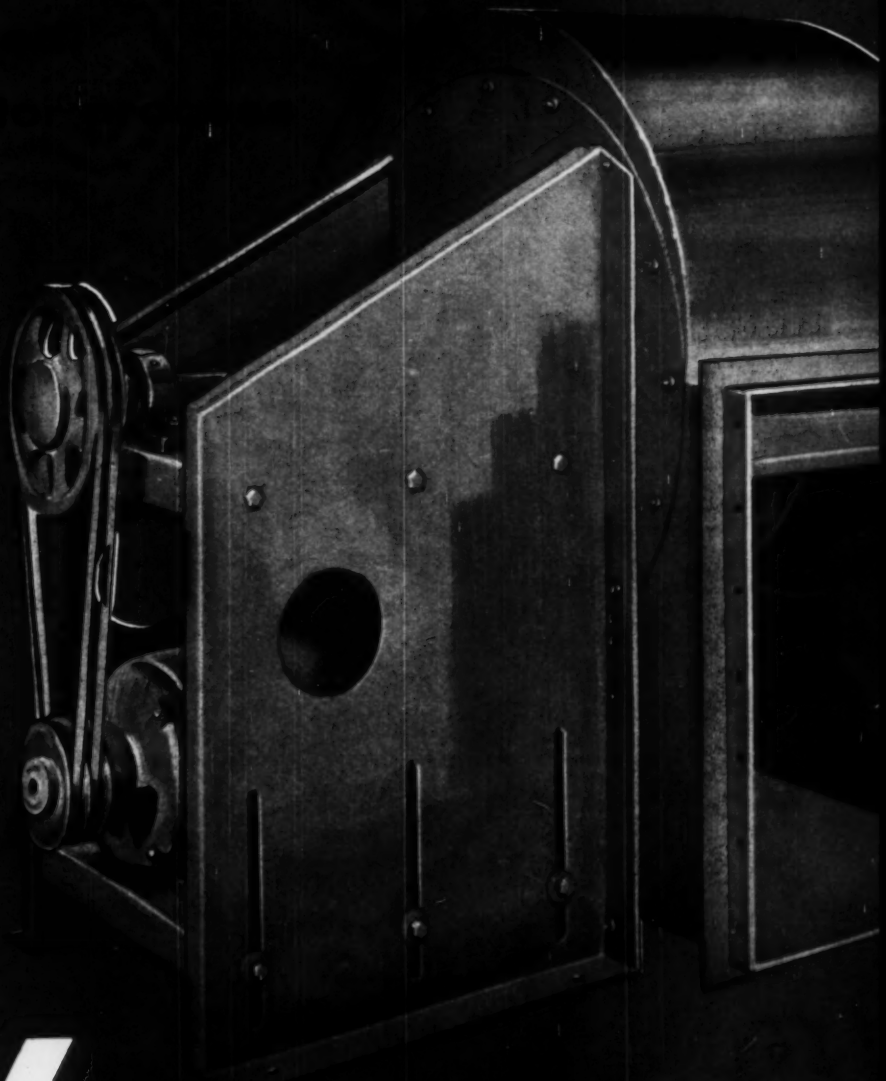

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RK
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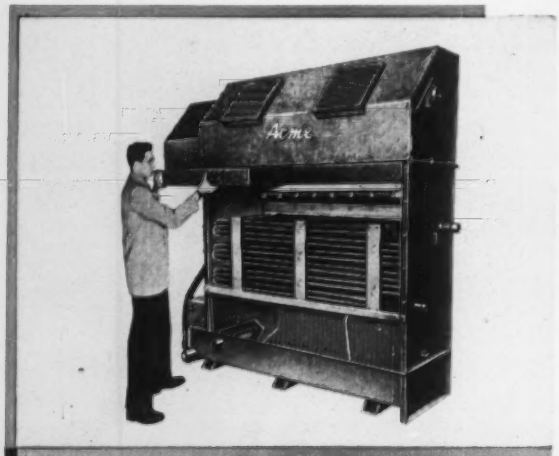
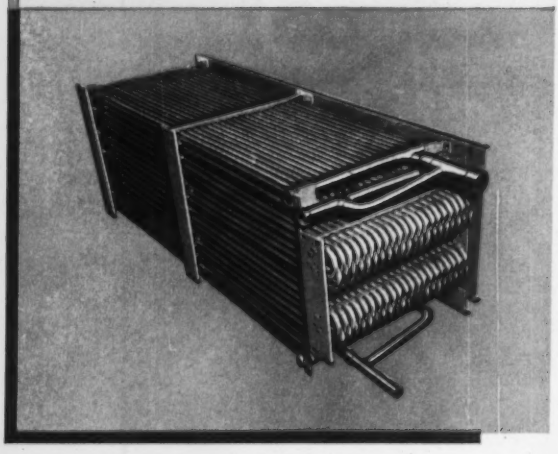
# BEAT HEAT WITH AN Acme FLOW-MIZER EVAPORATIVE CONDENSER

# Tubed with WOLVERINE Serpentine Coils



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Equally proud of the recognition won by Acme since its founding in 1919 is Wolverine Tube. Over the years Wolverine has supplied Acme with mile after mile of gleaming, copper refrigeration tube—such as that illustrated at left in the Acme Flow Mizer Evaporative Condenser.

This nationally-known unit is widely used in both general air conditioning and refrigeration and in specialized industrial applications such as the cooling of plating solutions, chemicals, oils and other fluids.

In this unit, the tube bundle is fabricated by Wolverine into serpentine coils—each of considerable length. Thus, because of its fabrication facilities and know-how, Wolverine helps Acme obtain maximum condensing efficiency in a minimum of space. Also eliminated are the shipping, handling and assembly problems encountered in working with extremely long length tubing.

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***"Maintained Efficiency"***

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"GREATER CAPACITIES"

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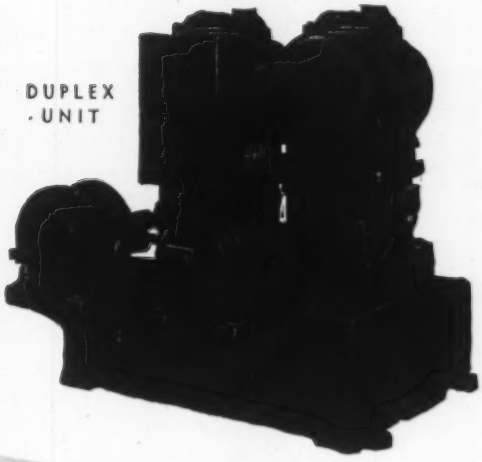

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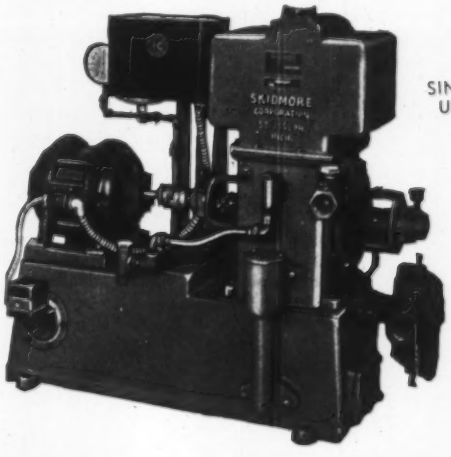
### GREATER EFFICIENCY AND CAPACITY

**Both the single and duplex unit automatically adjusts itself to the varying conditions of the system. Capacities ranging from 5,000 to 100,000 sq. ft. EDR.**



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Large-area, backwardly inclined blades have true nonoverloading power characteristic. Medium-speed operation with minimum fan size is ideal for either direct connection to motor *or* V-belt drive.

### CHOICE OF HEAVY-DUTY BEARINGS

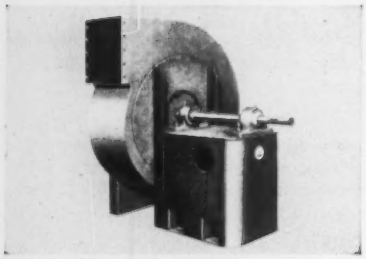
*Standard* – Heavy-duty, self-aligning ball-bearing pillow blocks.
*Optional* – Babbitted-sleeve, self-aligning type or roller pillow-block bearings.

# American Blower HS Fans hit top efficiency at medium speeds with minimum fan size

Versatile is the word for American Blower fans. For among this complete line of precision-built fans, you'll find an economical solution to *your* air-moving problem – whether it be ventilating, heating, drying or processing. And the heavy-duty construction of every American Blower fan guarantees you many years of low-cost, minimum-maintenance service.

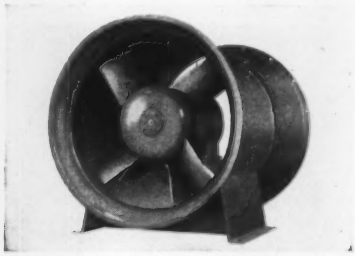
*Nationwide*, 73 American Blower factory branch offices are ready to serve you. At your request, skilled sales engineers will help select the equipment to handle your air-moving job best within your budget. Call today! American-Standard, American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

**It pays to standardize on American Blower fans for every duty!**



**Industrial Fans** – 3 optional wheels handle air, material, long shavings.

**Sirocco Fans** – low speed, quiet operation; move more air per revolution.



**Axial Fans** – move high volumes in minimum space; flexible installation.

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**Location:** Millville, New Jersey
**Architect:** Frank Grad & Son, Newark
**Associate Architect:** John A. Fletcher
**Contractor:** Benj. E. Labov & Son
**Chase Wholesaler:** Taylor Supply Co.

*H. Ragen, Job Superintendent, reports savings of time and costs through using Chase Copper tube. At left, Granville Dunleavy makes a solder joint in one of the many lines involved in this job.*

# "Every man on this job swears by Chase® Copper Tube"

## says Howard Ragen, Construction Superintendent on All Plumbing for Two Million Dollar New Jersey Office Building

Mr. Ragen is Job Superintendent for Benjamin E. Labov and Son, Plumbing Contractor on the multi-million dollar Tri-States Headquarters Building of The Prudential Insurance Company of America, soon to be opened.

Under his direction, more than two miles of Chase Copper water tube—from 3" down to ⅜" sizes—are being installed for hot and cold water supply lines, refrigeration and cooling.

Mr. Ragen says of copper tube:—
**"Every man on this job swears by Chase Copper tube. Our crews are saving time, getting more feet up per working day, and getting a better installation at lower cost per foot."**

Next time *you* figure a plumbing job, plan on using Chase Copper water tube. For when you figure the *total* cost—tube plus fittings plus time—you'll find *copper costs less* than rustable pipe. Copper is easier to preassemble. Joints are quicker and easier to make, cleaner, and remain pressure-tight. Long lengths need fewer connections, fewer fittings, and take less time to install and pressure-test.

Your nearest Chase wholesaler is ready to help you figure your next job with copper, so get in touch with him today. Insist on only copper tube made in U.S.A. Ask for Chase—pioneers in the use of copper water tube.

Chase®

**BRASS & COPPER CO.**
WATERBURY 20, CONN.
*Subsidiary of*
***Kennecott Copper Corporation***

***The Nation's Headquarters for Brass, Copper and Stainless Steel***
Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L.I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

JENKINS FIG. 106-A BRONZE GLOBE 150 LBS. STEAM . . . 300 LBS. O.W.G.

## in Disc Equipped Bronze Valves

LOOK **at that Wheel** — Tough malleable iron. Design unequalled for cool, sure grip.

LOOK **at the Index Plate** — Has Fig. No. etched in green background. Held by wheel nut which is secured by rolled-over spindle end.

LOOK **at that Spindle** — Made of high tensile bronze. See how much heavier it is . . . how many more deeply cut threads engage bonnet. And, the crowned head that reduces friction on disc holder. Sure, it costs more to make a spindle this way. But it reduces wear, preserves packing, means easier operation.

LOOK **at the Packing Nut and Gland**—Note the heavy and deep bronze hex. And, that bronze gland designed to compress packing toward spindle.

LOOK **at that Packing Box** — Its depth equals 1½ times spindle diameter. More packing space means less repacking. An asbestos, lubricated and graphited packing is used.

LOOK **at that Bonnet** — One-piece, screw-over design with big hex surfaces is easy to remove. Take an extra look at the bevel joint between bonnet and body, serving as an internal brace against the crushing effect of the bonnet assembly. Millions of Fig. 106-A in use for years prove this unique design licks distortion and springing.

LOOK **at the Disc Holder** — It's the Slip-on Stay-on type originated by Jenkins. Correct protective depth prevents flaking or cracking of disc.

LOOK **at the Disc** — Easily renewed without removing valve from line. Made of compositions to suit various services . . . and **made by Jenkins,** the only maker of both valves and discs.

LOOK **at that Body** — Just compare wall thickness of this high tensile bronze body with any other valve. The factor of safety is many times higher than rating requires. See the curved diaphragm to protect seat from distortion by pipe strain. Note that the raised seat is higher to permit more reseating operations . . . and wider, so it won't cut into disc. Pipe threads are full length and clean cut.

LOOK **at this . . . for Throttling** —Just replace the standard disc nut with this Throttling Nut and a Fig. 106-A becomes well-suited to throttling service. This unique nut reduces the effects of wire drawing and its long legs restrict flow for accurate control. Many plants take advantage of this versatile valve to reduce valve and parts inventory.

**THE FIRST** renewable composition disc valve was a Jenkins Valve, originated nearly a century ago. Compare today's Fig. 106-A Bronze Globe with any other. See why so many valve users agree that a *Jenkins* is still the FIRST for top value. For descriptive folder No. 189-B on the full line of Jenkins Bronze Globe, Angle and Check Valves write to Jenkins Bros., 100 Park Avenue, New York 17.

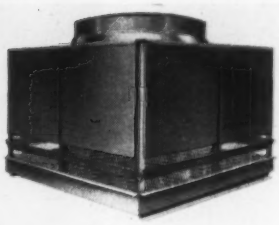
JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

# EQUIPMENT DEVELOPMENTS . . .

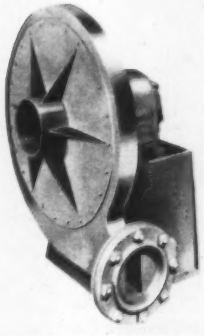
*For reviews of Recent Trade Literature see page 232*



## Cooling Towers . . .

. . . in 5 to 150 ton capacity range—*Dover Mfg. Co., Dept. HPAC, 3117 Weatherford Ave., Independence, Mo.*

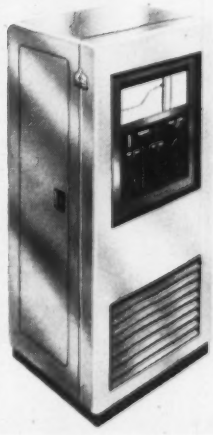
"Sillowette" is a counterflow, mechanically induced draft tower with propeller fan and vertical air discharge. Features cited: removable side panels lift out with no bolts or screws to unfasten and expose interior of tower; air cooled bearings set in bearing housing with separate air and grease lines running to outside of tower; right-angle utility sump simplifies tower flushing, protects pumping equipment from debris and air pockets. When cooling capacity requirements exceed 150 tons, towers can be flange-assembled to provide multicell tower.



## Pressure Blowers . . .

. . . designed to efficiently furnish air at high pressure for use with oil, gas burners, air curtains—*Chicago Blower Corp., Dept. HPAC, 9863 Pacific Ave., Franklin Park, Ill.*

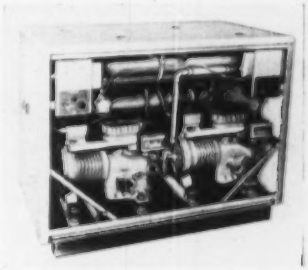
Turbo-pressure blowers designed to maintain constant pressure while supplying varying volumes of air. Power consumption curve closely proportional to amount of air used or delivered, says manufacturer. Rotating elements of blowers of light weight, high strength construction. Blowers are of one type, regardless of size or whether for pressures from 4 to 24 oz. Must be operated at 3450 rpm, require 60 cycle current.



## Vacuum Thermal Balance

. . . intended to exploit thermoanalytical techniques of thermogravimetry—*American Instrument Co., Dept. HPAC, 8030 Georgia Ave., Silver Spring, Md.*

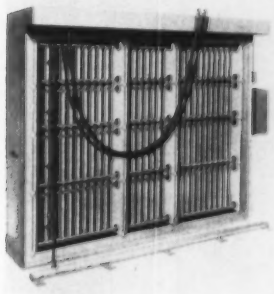
"Thermo-Grav" automatically records changes in weight as function of temperature and changes in weight as function of time at constant temperature. Instrument consists of precise spring balance enclosed in glass chamber for operation under vacuum or in gaseous atmospheres at, or below, ambient pressure; two furnaces; linear transducer and recording system; temperature programming. Spring deflections, proportional to changes in sample weight, converted into signals by transducer. Signals, together with those corresponding to sample temperatures or time, furnish X-Y recorder with inputs necessary to trace cartesian coordinate graph depicting relationship. Unit is self-contained, a-c operated.



## Packaged Chillers . . .

. . . in 10 and 15 hp models—*Embassy Steel Products, Inc., Dept. HPAC, 890 Stanley Ave., Brooklyn.*

Both models, "EWC-100" and "EWC-150," have twin systems and two hermetic compressors. Condensers, chillers, valves, controls can operate singly or as dual unit. They are semi-cleanable with detachable heads on water inlet side. Test cocks facilitate checking of refrigerant level.



## Dust Precipitator . . .

. . . in new design intended to operate at face of velocities up to 600 cfm—*American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8, Ky.*

Electronic unit features 30 percent reduction in actual size, 50 percent reduction in cubic requirement; also 16 percent shallower than previous models. Sectional construction has individual cells with positive, negative collector plates fixed in position. Each cell has own set of vertical ionizing wires. Available in heights 16, 20 in., widths 24, 36 in. Cell capacity ranges from 800 to 2750 cfm.

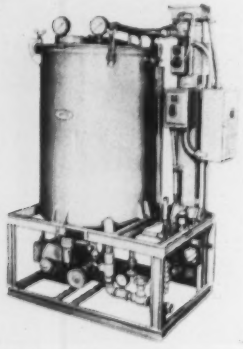
## EQUIPMENT DEVELOPMENTS

*Continued*

### Power Roof Exhauster . . .

. . . in 75 to 2200 cfm range—*Greenheck Fan & Ventilator Corp., Dept. HPAC, Schofield, Wis.*

All exposed surfaces of "Columbus Series C" power roof exhauster are of heavy gage aluminum for durability, light weight. Aluminum, nonoverloading centrifugal wheels coupled in direct drive to ball bearing motors mounted out of exhausted air stream, isolated from housing for quiet operation. One piece inlet cone, curb gives weathertight construction. Complete line of accessories available.



### Oil Dehydration System . . .

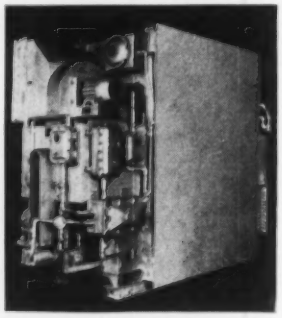
. . . developed to dehydrate, filter, deaerate lubricating, insulating, cooling, hydraulic, other industrial oils —*Bowser, Inc., Dept. HPAC, Fort Wayne, Ind.*

New system, "Fil-Thermo-Vac," recommended by manufacturer for oils to 5000 ssu viscosities, also said to accomplish dehydration to near zero point while removing 99 percent of solids and entrained or dissolved air, gases. Systems produced in three sizes, several types.

### Fire Alarm System . . .

. . . for use in commercial, industrial, public buildings—*Minneapolis-Honeywell Regulator Co., Commercial Div., Dept. HPAC, 2753 Fourth Ave., S., Minneapolis, Minn.*

Detectors will sound alarm if temperature rises at abnormal rate (15 deg per min or more) or whenever temperatures exceed 135 deg (in areas where normal ceiling temperature does not exceed 100 deg) or 180-200 deg (where normal ceiling temperature does not exceed 150 deg). Included in system is central control panel containing numbered indicating lights to show zone in building where fire is, thermostat size fire detectors, fire warning device (bell, horn or buzzer), manual fire alarm station. Panels may be provided with auxiliary relay contacts for automatically tripping municipal fire alarm boxes. Can be installed in existing buildings; wiring need not be in conduit.



### Dehumidifier . . .

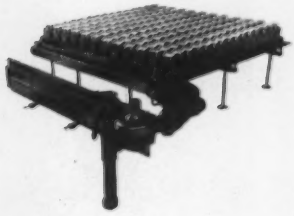
. . . developed for moisture control in commercial storage applications, pharmaceutical plants, chemical processing facilities—*Dryomatic Corp., Dept. HPAC, 806 N. Fairfax St., Alexandria, Va.*

"Model 1500" removes up to 40 lb of water per hr, will maintain humidity levels as low as 10 percent RH. Machine uses two beds of permanent silica drying agent; while one bed removes moisture from the air, other is regenerated by electricity, steam or gas heat. Alternate adsorption, reactivation periods are spaced by adjustable timers to provide economical operation under varying weather conditions, says manufacturer.

### Vertical Motors . . .

. . . designed for direct mounting on high-thrust pumps—*Reliance Electric and Engineering Co., Dept. HPAC, 24701 Euclid Ave., Cleveland 17.*

New vertical solid shaft, high-thrust p-base motors available in sizes 1 to 40 hp. Sizes 20 hp and up oil lubricated. "Bonnet" design of splash cover permits stacking of additional bearings to absorb high up-and-down thrust loads, says manufacturer. Unit has automatic grease relief. Motors available in standard speeds to 3600 rpm, have iron external construction, corrosionproof internal construction as well. Explosionproof feature also provided. Construction features cited: cast iron conduit box with tight fitting; neoprene shaft slinger; indexed neoprene lead gasket; two eyebolts; protective screening.

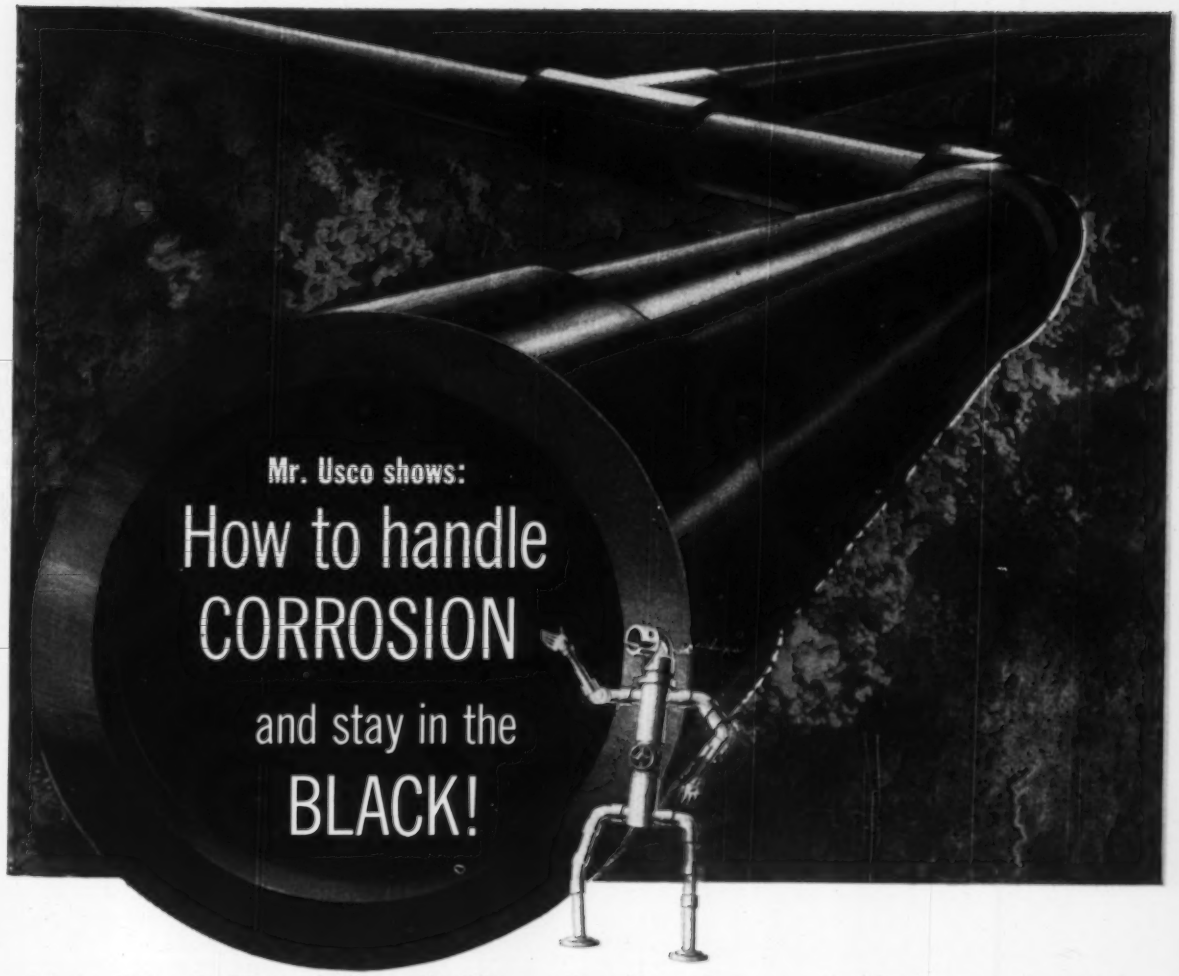


### Gas Burners . . .

. . . designed to eliminate need for metal parts in heat zone—*Power Flame Div., Inc., Dept. HPAC, 1203 Main St., Grandview, Mo.*

"U-400 Thoro-Mix" vertical flame, ceramic head burners can be operated at any pressure above 1 in. WG without flashback, says manufacturer. Available in sizes 200,000 to 12 million Btu.

USCOFLOW PLASTIC PIPE




## New black UscoFlow Utility plastic pipe and fittings provide economical corrosion resistance—inside and out

A blend of styrene-base resins and synthetic rubber to give good impact resistance and high, effective tensile strength...

A simple installation—rapidly solvent welded...

A friction-free finish that maintains high flow-rate and resists build-up of scale or other deposits...

An economical price to solve corrosion and high installation cost problems that would ordinarily chew into your profits...

All this is the *new* UscoFlow line of black plastic pipe and fittings, specially designed for economical and efficient handling of fluids. It has already proven its long service life, free of maintenance and downtime, and is recommended for such applications as

**salt-water lines** **fresh-water lines***
**natural-gas lines** **electrical conduit**

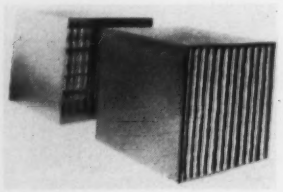
A full selection of UscoFlow pipe and fittings—plus expert engineering assistance—is available at any of the selected "U. S." Distributors, at "U. S." Branch Offices, or by contacting us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

*Uscolite is approved by the National Sanitation Foundation for use with potable water.

Mechanical Goods Division

**United States Rubber**

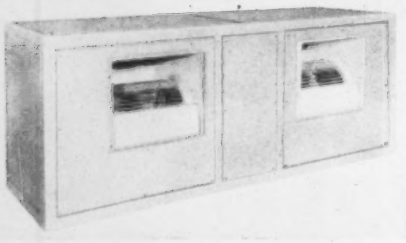
See things you never saw before. Visit U. S. Rubber's new Exhibit Hall, Rockefeller Center, N. Y.



### High Velocity Filter . . .

. . . designed to handle greater air volumes—*Cambridge Filter Co., Dept. HPAC, 738 E. Erie Blvd., Syracuse 3, N. Y.*

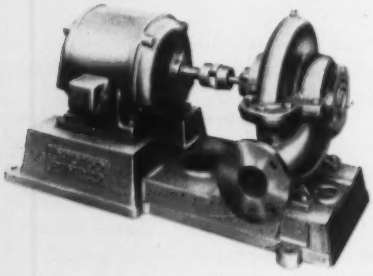
Depth of high velocity "Aerosolve" unit increased to 24 in., against 12 in. depth of standard unit, giving 86 sq ft of filter area, 450 fpm face velocity, 1800 cfm. Unit consists of permanent cadmium plated steel frame with completely assembled, replaceable filter cartridge. Cartridges, with different filtering media available in 95, 85, 35 percent efficiencies. Initial pressure drops for cartridges range from 0.25 in. WG to 0.45 in. WG. New filter is fire resistant.



### Air Cooled Condensers . . .

. . . with centrifugal fans for indoor applications—*Halstead & Mitchell, Dept. HPAC, Bessemer Bldg., Pittsburgh 22.*

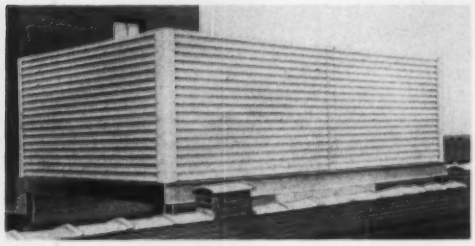
"Type BC" has coils with exclusive fin design for greater heat transfer. Centrifugal fans permit use of ductwork. Condensers designed for ceiling mountings. Wide range of capacities.



### Split-Case Pumps . . .

. . . designed for quiet operation—*Chicago Pump Co., Dept. HPAC, 622 Diversey Pkwy., Chicago 14.*

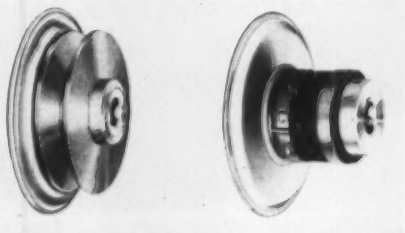
"Type S" is designation given to company's new line of horizontally split-case, single stage, centrifugal pumps. Features cited: pre-lubricated bearings; ceramic mechanical seals eliminating stuffing box drip and piping to drain; compact overall dimensions. Recommended by manufacturer for air washing, chilled water circulating, condenser water service, cooling tower circulating, boiler feed, condensation, hot water circulating, etc.



### Cooling Tower . . .

. . . in completely enclosed design—*Marley Co., Dept. HPAC, 222 W. Gregory Blvd., Kansas City 14, Mo.*

"Underflow Aquatower" is cooling tower that exposes no louvers, fan, piping. Functional principle combines cross flow, forced draft, double flow designs. Heavy duty fan located at bottom of unit blows air upward into plenum chamber where it is diverted through filling in dual cooling areas and discharged vertically through air outlet openings at each end of top of tower. Discharging air into plenum chamber and passing it through the filling has tendency to lower operating sound level of units. With encased design, not necessary to screen enclosures.



### Drives and Couplings . . .

. . . in fractional hp units—*Dodge Mfg. Corp., Dept. HPAC, 500 S. Union St., Mishawaka, Ind.*

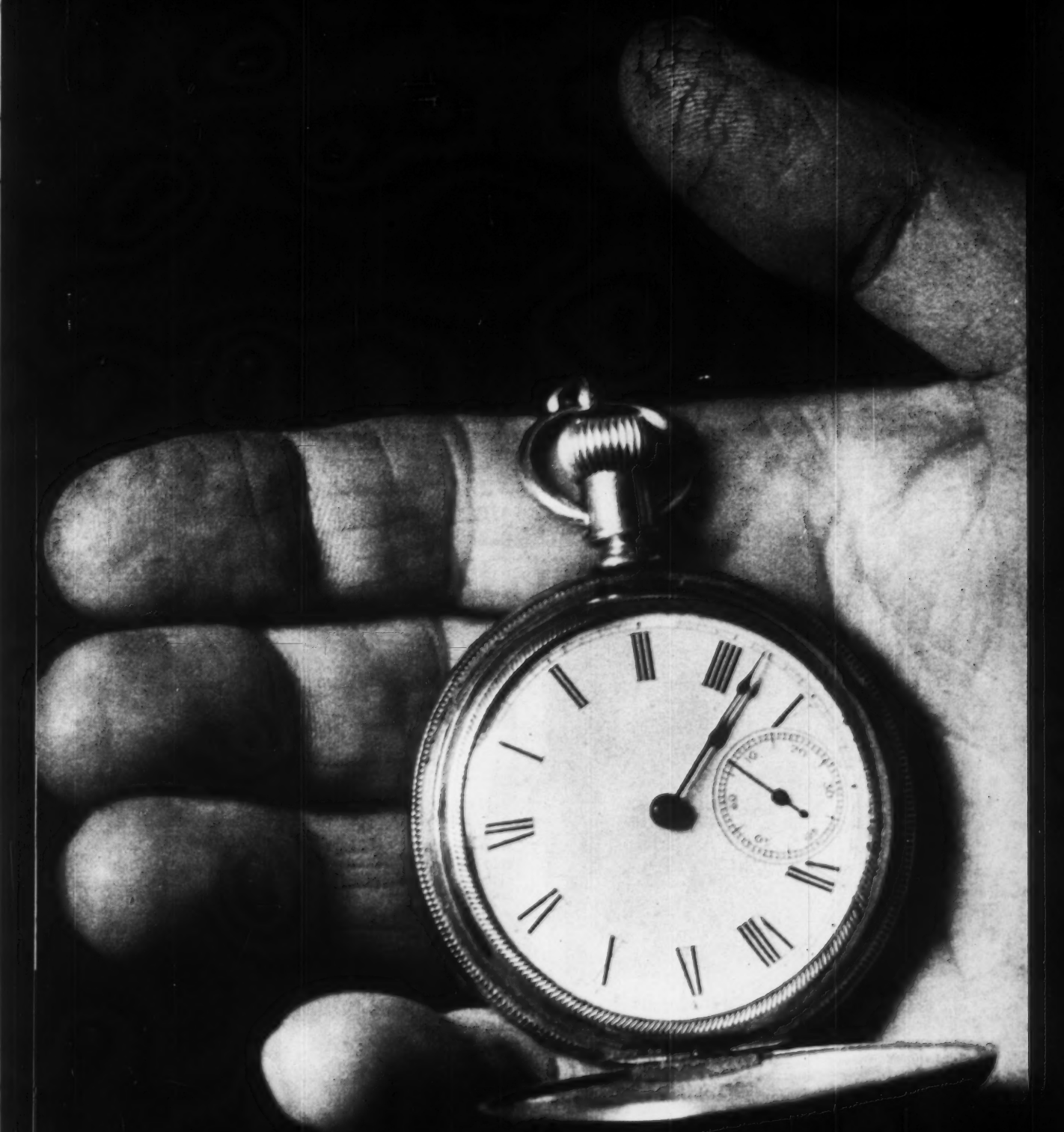
"5D" and "5C" models provide additions to "Flexidyne Dry Fluid" line. Designed for ¼, 1/3, ½, ¾ hp motors at 1750 rpm; recommended for use with light machines subject to jam-ups or to enable small motors to handle heavy starting loads. Operating advantages include cushioned starting, protection against overloading.

### Flow Control Valve . . .

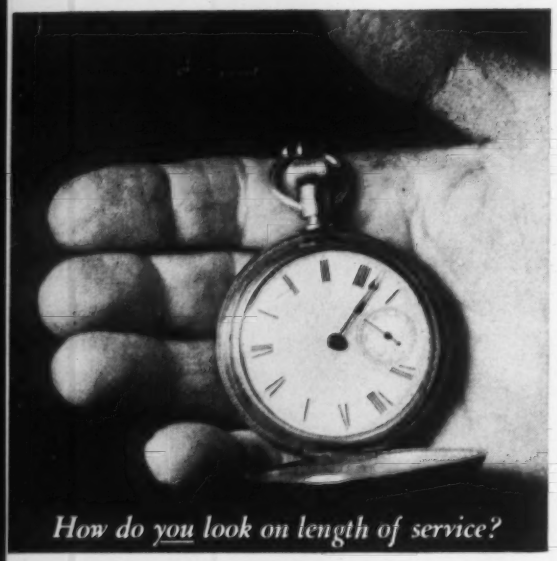
. . . designed to control the flow of water to specified gpm rating at pressures 15 to 125 psi, temperatures to 160 F—*Cepi-American, Inc., Flow Control Div., Dept. HPAC, 7767 North Ave., River Forest, Ill.*

"Cepi" automatic flow controls manufactured in sizes to handle flows ¼ to 600 gpm. Flexible washer

(*Continued on page 164*)



*How do you look on length of service?*



*How do you look on length of service?*

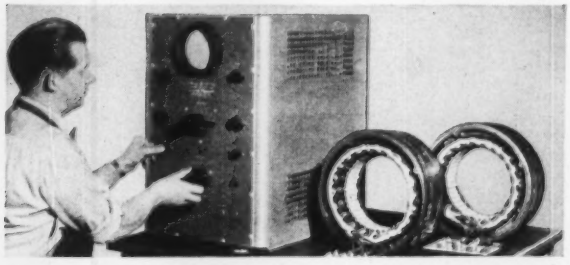
## When it's ventilating equipment...

How important is length of service life in ventilating equipment? Is it *most* important to those who specify? Or are there other features that rate even higher?

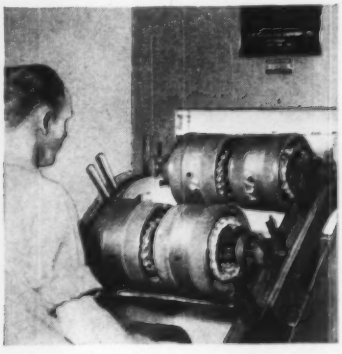
We wanted to know for sure. So we retained an independent research organization to make a nationwide survey among consulting mechanical engineers to see what

## *Here's why* ILG *self-cooled motors, last a lifetime,*

***Cool Heads . . . and Hands*** call for Ilg self-cooled motors: No overheating; no "shorts" to shorten fan life. Ilg-built direct-connected motors operate inside a casing . . . draw outside air through vent tube to keep motor running clean and cool. Ilg permanent-split capacitor single-phase and 3-phase motors have lower starting torque, permanently lubricated ball bearings, *no* parts to wear, longer life.



***Surge of Power.*** All Ilg motor windings are Surge-tested by voltages comparable to those induced in power lines by lightning. This turn-to-turn voltage torture test reveals any winding insulation weakness or other variations from specifications.



***Dry as Dust.*** Ilg wound motor cores have no weak spots vulnerable to moisture. Patented Zanderoll process preheats cores, dips them into thermosetting varnish, bakes them until varnish sets and cures. Process assures uniform and complete impregnation of motor windings.

## For fans built to satisfy your "specs"...

# consulting engineers vote for long life time after time

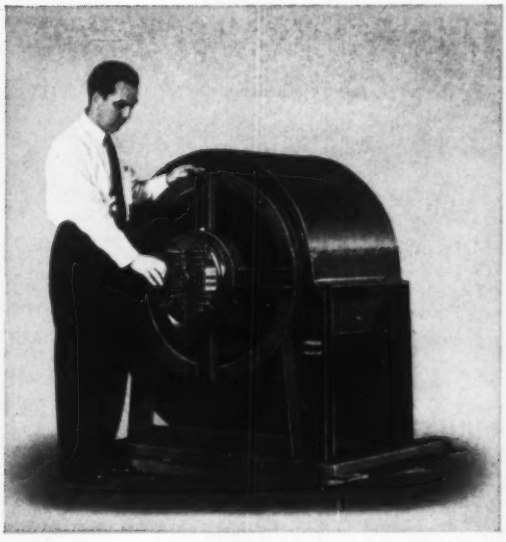
*they* looked for in ventilating equipment.

Results? Nearly 75% of the engineers consulted placed *long life* high on their list of "most-looked-for" qualities.

Note below some of the reasons why Ilg fans and ventilators give such *long service* . . . why Ilg equipment has built in many of the other points of preference—such as quietness and vibration-free operation—asked for by consulting engineers.

For further details of why Ilg rates so high with those who specify, send for Catalog No. 153 on propeller fans, Bulletin No. 257 on airfoil centrifugals, Bulletin Nos. 2301 and 2700 on power roof ventilators.

## ILG *fans and ventilators cost little to maintain*



***Strong, Silent Type.*** Ilg BC Airfoil Centrifugal Fans can run at greater speed than older types—with *no increase in sound level.* Direct-connected Ilg-built motors and Airfoil fan wheels rotate as a *single unit* . . . eliminate the need for noisy belts and pulleys, space-wasting separate motor mountings, eddy currents and turbulence. Sized for operations to 9" static pressure.

***Holds "Heart" in Hands.*** Under the aluminum housing of this Ilg Power Roof Ventilator "beats" a long-lived, permanently lubricated Ilg motor direct-connected to Ilg's Backward Curved Aluminum Airfoil Centrifugal. Ilg patented pressure-type, self-cooled motor and motor compartment eliminate heat build-up of *any* type, assure longer motor life.

specify ILG

**ILG ELECTRIC VENTILATING COMPANY**
2826 N. Pulaski Road, Chicago 41, Illinois
Offices in 57 Principal Cities

ACCEPTED Allen
ROOF VENTILATION

Whatever your ventilating needs, be sure to see how Allen equipment can meet your requirements efficiently and economically.

NEW "I-LINE" for EYE APPEAL

The new "I-Line" provides an attractive low contour, assuring maximum capacity or efficiency with the minimum over-all height.

POWERFUL "VD" for HIGH VELOCITY

By moving a large volume of air at high velocity, this Vertical Discharge fan keeps fumes from sifting back into building.

Allen

. . . is prepared to investigate ventilating problems and plan systems for the efficient removal of heat, fumes, vapor or dust.

WIND-DRIVEN TURBINES

Three types of Allen turbines take full advantage of the economy of natural air movement.

EXHAUST FANS

Remote drive Staxauster is designed to handle corrosive fumes, and/or high temperature air.

THE ALLEN LINE

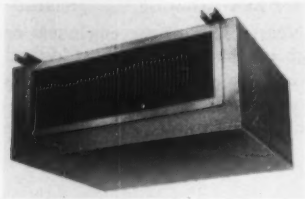
Write today for catalog that gives specifications and performance data on these and other units in the Allen ventilator line.

ALLEN COOLER & VENTILATOR, INC.
ROCHESTER MICH.
Roof Ventilators for Every Commercial and Industrial Need
REPRESENTATIVES IN PRINCIPAL CITIES

## EQUIPMENT DEVELOPMENTS

*Continued from page 160*

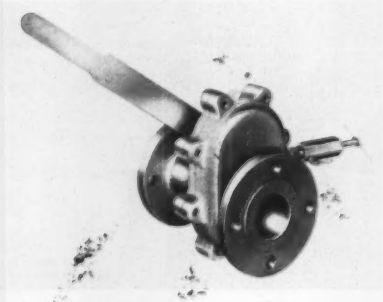
adjusts itself into conical base, depending on pressure, controls flow at 5 percent. Standard models available in sizes 3/8, 1/2, 3/4 in. for flow rates to 10 gpm. Multi-orifice units also available in pipe sizes to 10 in. for flows to 600 gpm. Recommended by manufacturer for cooling water circuits, backwash controls, spray rinse equipment. Will help balance water distribution systems by controlling flows at outlets.



### Remote Condensers . . .

. . . in eight models ranging from 1½ to 10 ton capacities—*A. H. Witt Co., Inc., Dept. HPAC, 940 N. Sycamore, Los Angeles.*

Cabinet units designed for direct expansion, hot or cold water or direct expansion and water. No duct work or tearing out partitions for installation required. Quietness of operation with "Zone Air" is stressed by manufacturer.



### Swing Gate Valve . . .

. . . designed to provide quick, easy, tight shutoff of flow under high pressure operating conditions—*W. S. Rockwell Co., Dept. HPAC, 200 Eliot St., Fairfield, Conn.*

Gate or disc of "Lubeseal" valve is first swung into closed position by hand lever. To assure positive tightness, plastic lubricant is forced down through channels by turning hand screw projecting from valve body. High pressure of lubricant against periphery of gate and its seat holds faces of gate tight against body. When lubricant is under pressure little cock on lubricator is closed. To open, cock is opened, screw is backed off to relieve lubricant pressure in valve body and disc lever is moved without difficulty. Valve may be used on any fluid where possible slight contamination of stream by lubricant is inconsequential. Available in any cast iron, other alloys in 1½, 2½ in. sizes.

Room in 50-year-old single home modernized into two apartments by Mr. Arthur Stockdale, Cleveland, Ohio, shows contrast between old and new in steam heating. Trim, compact SelecTemp unit at left (only 18" high) has maximum heat output of 12,000 Btu per hour. Built-in modulating non-electric thermostat controls forced circulation of filtered warm air.

## Individual room-by-room temperature control now economical and practical

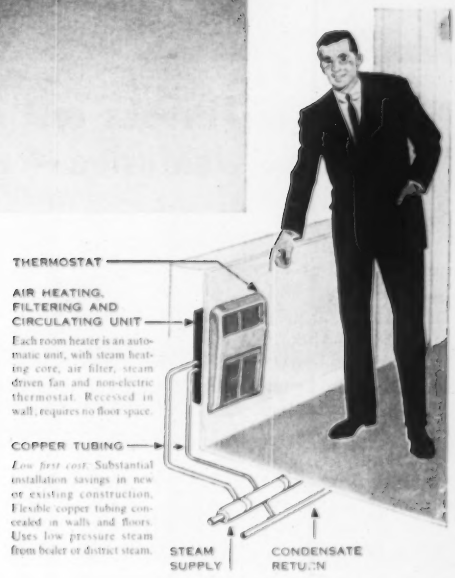
The Iron Fireman SelecTemp heating system has the basic economy and efficiency of steam heat, but with all of these added advantages:

***A thermostat in every room.*** Occupants choose the temperature they prefer. More important, each room gets just the amount of heat it needs, regardless of heat from sun or fireplace or heat loss from cold winds.

***Modulating heat control.*** The *volume* of heat is constantly adjusted to room needs—a little or a lot as required. No "on-off" cycling.

***Amazing capacity in small space.*** SelecTemp compactness is due to the extremely efficient honeycomb copper heat exchanger, together with forced air circulation, delivering up to 120 cfm from the 12,000 Btu room unit (shown above), only 18" x 13⅝" in size.

For more information see catalog in Sweet's Architectural and Light Construction files, or mail coupon.


THERMOSTAT
AIR HEATING, FILTERING AND CIRCULATING UNIT
Each room heater is an automatic unit, with steam heating core, air filter, steam driven fan and non-electric thermostat. Recessed in wall, requires no floor space.
COPPER TUBING
Low first cost. Substantial installation savings in new or existing construction. Flexible copper tubing concealed in walls and floors. Uses low pressure steam from boiler or district steam.
STEAM SUPPLY
CONDENSATE RETURN

**FOR BUILDINGS AND HOMES**

SelecTemp installations now in use range from medium size homes to large office buildings with hundreds of room units. SelecTemp heating has proved widely adaptable. Churches can heat rooms for mid-week use without heating the entire building. Hospitals can meet patients' special needs, while non-electric fans and thermostats make SelecTemp units safe in operating rooms. Motels cut fuel bills by reducing daytime room temperatures; rooms are quickly reheated, as needed. In apartment buildings and dormitories, individual room thermostats end tenant complaints. Schools can keep the gymnasium cool and study and classrooms at the desired warmth. Homes can have cool sleeping rooms; warm bathrooms and nursery. Experience proves fuel and maintenance costs are low. Initial cost comparable to conventional hot water and steam systems, which do not have room-by-room control.

IRON FIREMAN MANUFACTURING COMPANY
4084 West 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ont.)

☐ Send SelecTemp specifications and full information.

☐ Arrange for brief demonstration of SelecTemp room unit; in actual operation, in our office.

Name_____

Firm_____

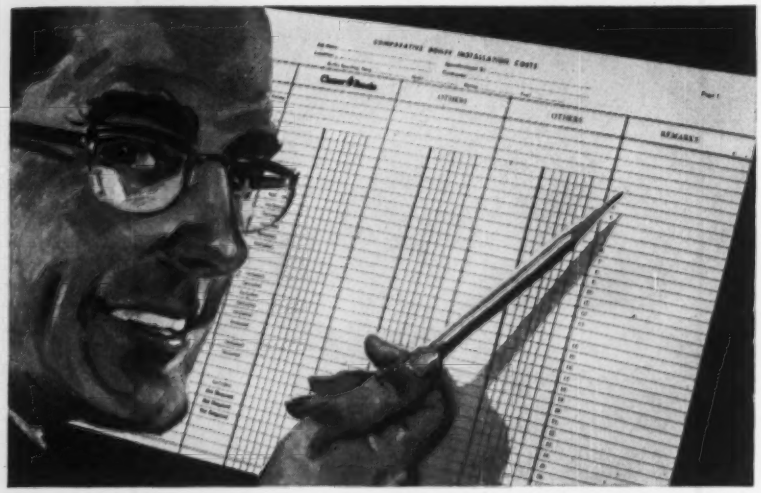
Address_____

City_____ State_____

# IRON FIREMAN®

*Engineered* **Heating and Cooling**

## Before you buy any boiler
## compare quoted prices with REAL COSTS



## New Cleaver-Brooks cost analyzer clears "quotation" confusion — reveals ALL costs

Get *all* the costs . . . the *real* costs . . . down on paper before you recommend or specify a boiler to your clients. On many boiler installations "quoted prices" seldom agree with the total costs, as you may have learned. This is frequently the case with so-called "built-up" boilers assembled on the site.

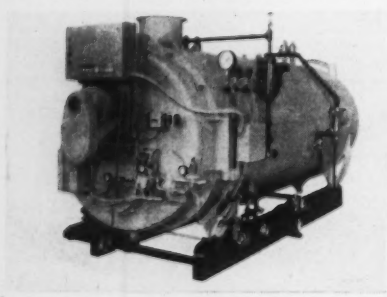
Cleaver-Brooks' cost analysis enables you to compare all material costs (boiler, steam trim, burner, refractory, controls and other equipment) and installation labor costs. You'll know the "real costs" on the complete installation before you start.

### Real eye-opener

The figures you'll see may be startling. In most cases the cost analysis proves a Cleaver-Brooks costs *less*. On-job time is drastically reduced because Cleaver-Brooks packaged units are fully assembled, ready to install. Cleaver-Brooks boilers give you more in performance, too . . . each boiler is fully fire-tested at the factory under load, tuned to peak economy. Starting service and on-the-job operator training by authorized field engineers further decreases your over-all costs.

### Contact your Cleaver-Brooks agent

Once you add up all the benefits of a Cleaver-Brooks "one-cost" package . . . the proved trouble-free economy of exclusive four-pass, forced-draft design, you'll find it pays over and over to analyze costs carefully before you buy. See your Cleaver-Brooks agent for details or write Cleaver-Brooks Company, Dept. H, 313 E. Keefe Ave., Milwaukee 12, Wisconsin.

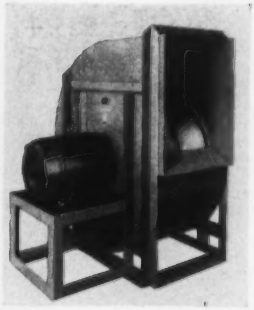


*Choose from 19 sizes, 130 models, 15 to 600 hp. Oil, gas and combination oil/gas fired — steam or hot water for heating or processing.*

Cleaver Brooks®
ORIGINATORS OF SELF-CONTAINED BOILERS


## EQUIPMENT DEVELOPMENTS

*Continued*



### Direct Drive Blower . . .

. . . designed with no obstructions in air inlet—*Peerless Electric Co., Fan and Blower Div., Dept. HPAC, 1401 W. Market St., Warren, Ohio.*

Non-overloading Class 1 direct drive blower available in volumes 1110 to 24,560 cfm, sizes 12 to 36 in. Frames, housings constructed of heavy gage metal, arc welded together in integral piece. Wheels also of welded construction, statically, dynamically balanced, mounted on motor shaft with tapered lock bushing with keyway. Construction features cited: drive covers; vibration pads, bases; spark resistant construction; inlet vane control; access doors; inlet or discharge screens; flanged inlets, outlets; automatic or motorized discharge dampers; drain fittings; special finishes, construction for handling hot gases to 500 F. Furnished with company's standard motors, totally enclosed or explosion-proof, as specified.

### Air Flow Indicator . . .

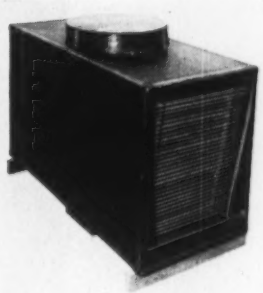
. . . designed to chart, improve efficiencies in all flow of gases, liquids —*Design Engineers, Dept. HPAC, 214 S. Church St., Rockford, Ill.*

"Visu-Flo" utilizes petroleum mixture for fuel. Smoke drawn into console at manually adjustable rate. Manifold pressure ejects smoke from numerous equally spaced jets, horizontally, left to right, between two heavy plates of glass. Outdoor air introduced into spaces between jets of smoke. Procedure results in laminated pattern of alternate jet streams, variations of which can be observed, recorded. Air stream can be manually adjusted in speed through wide

## EQUIPMENT DEVELOPMENTS

*Continued*

range, providing pressure feed or vacuum exhaust or combination of both. Control system allows simulation of velocity change or adjustable readability of smoke pattern. Operates on 115 volts, 60 cycle.



### Cooling Towers . . .

. . . produced in eleven models from 5 tons—*Marley Co., Dept. HPAC, 222 W. Gregory Blvd., Kansas City, Mo.*

"Permatowers" are constructed for maximum resistance to corrosion. Reinforced polyesters, phenolic and kralastic resins and resin-protected laminates used in construction. All models equipped with enclosed motors. Water distribution system incorporates molded kralastic type resin riser, header and distribution manifolds. Recommended by manufacturer for any application where permanence is factor.

### Valve Monitoring System

. . . designed to check, indicate malfunction in operation of its automatic demineralizing plants—*Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York* 11.

"Graver Monitor" provides "electric shadow" which follows cycle control sequences and operation of automatic valves, auxiliaries. If valve operation or sequence not in proper order, or component of automatic system not functioning properly, impulses are received from "feedback," indicating, locating problem. Unit can be arranged to sound alarm, shut down plant or both. Panel has three groups of lights: one group shows if

It takes less than a quarter turn to open an Everlasting Valve *wide* or close it *tight*. That's one of the many reasons why these time-proven valves are so popular wherever quick valve action is desired . . . on equipment outlets, storage and measuring tanks, process lines, boiler blow-offs, spray lines, meter testing, etc.

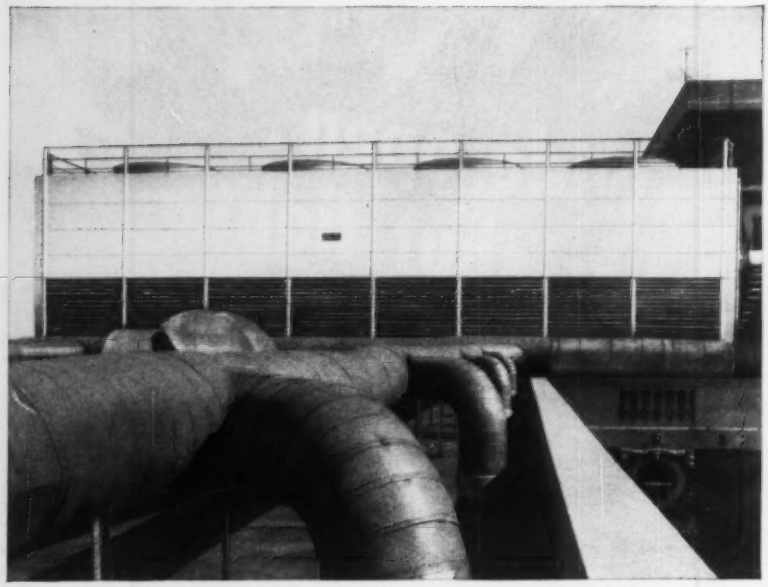
**Write for Bulletin E160 describing their many other important advantages and with full information on types, sizes, etc.**

*For "everlasting" service, use*

EVERLASTING Valves

EVERLASTING VALVE CO.
61 FISK STREET, JERSEY CITY 5, N. J.

EV380



This Binks cooling tower, atop the Palmer House, is the heart of a newly augmented air conditioning system for 1735 guest rooms, dining and shopping facilities.

**at the Palmer House in Chicago...**

## air conditioning water costs cut 96% by Binks cooling tower

"Our Binks cooling tower has done a great job for us," reports Chief Engineer John F. Edelhofer of the Palmer House Hotel. "Since June of 1956 our records show air conditioning water costs are only 4% of what they would have been under our old 'one-pass' system. In terms of volume, we are saving almost 7700 gallons per minute of operation. The tower should pay for itself in five years."

**Cooling tower features**

This tower is one of Binks 2-K vertical induced draft series. It cools and recirculates 8000 gallons per minute. Water enters at 95°F and leaves at 85°F. Four 12' diameter aluminum alloy fans assure scientifically balanced air-to-water ratio for high cooling efficiency under all climatic conditions. All panels and framework in the 72' by 42' tower are heavily galvanized and coated to insure minimum maintenance.

**A complete line**

Whether it is for air conditioning or the cooling of manufacturing process fluids, there is a Binks cooling tower of the correct capacity and type for every job.

**Send for complete data**

Ask your Binks branch office for a copy of Bulletin 333 and Bulletin 477-A or write direct to the address below. Binks engineers will be glad to answer your questions and help you solve your cooling problems. There's no obligation.

**Binks**
*EVERYTHING FOR WATER COOLING*

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

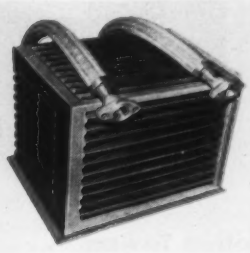
**Binks Manufacturing Company**
3118-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES · SEE YOUR CLASSIFIED DIRECTORY


## EQUIPMENT DEVELOPMENTS

*Continued*

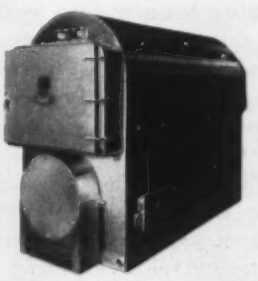
demineralizing units are in service, regeneration, backwash, rinse; second indicates step in process taking place; third has series of three lights for each valve, pump, other auxiliary —first light on when valve or item is supposed to be open, second when it is actually open, third when not functioning in proper sequence.



### Heat Exchanger . . .

. . . designed to operate under reduced pressure with high degree of heat transfer for cooling, heating —*Tenney Engineering, Inc., Heat Transfer Div., Dept. HPAC,* 1090 *Springfield Rd., Union, N. J.*

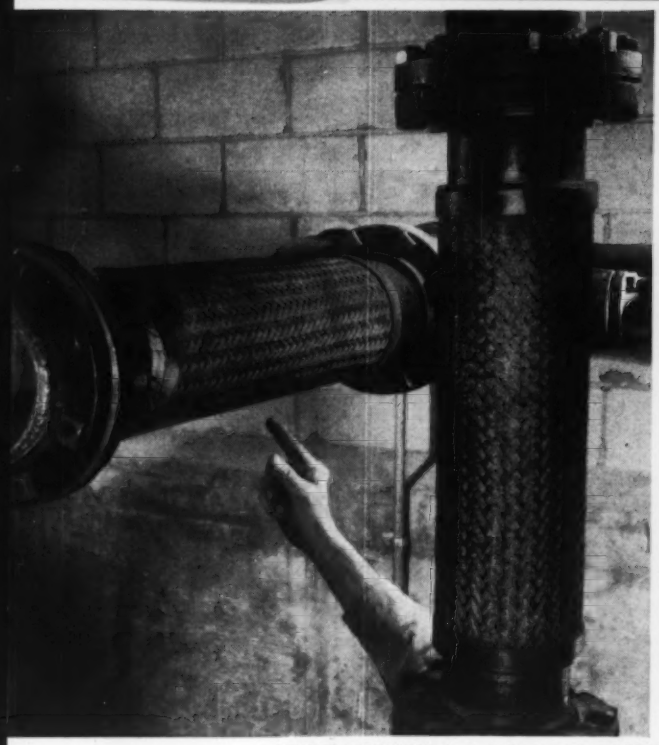
New line of high capacity heat transfer surfaces intended for wide range of industrial, military applications as oil and fuel coolers, air to air exchangers, liquid to air exchangers, liquid to liquid exchangers, saturated vapor to air exchangers, as evaporators and condensers for compartment cooling.

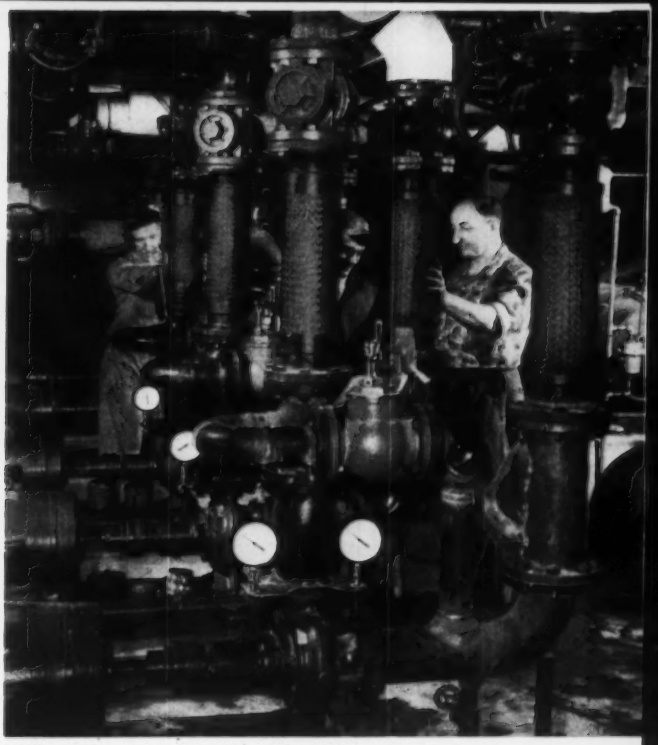


### Steam Boiler . . .

. . . with "wet leg" construction— *Federal Boiler Co., Dept. HPAC, Granite and West Sts., Midland Park, N. J.*

Use of "wet leg" base, with front, sides, rear of combustion chamber





PHOTOS PROVIDED through the courtesy of GRAFLEX, INC., manufacturers of precision photographic, electronic and optical products, at the company's new multimillion-dollar Rochester, N. Y., plant.

# New Flexpipe flexible bronze tubing isolates vibration, provides expansion joint for Graflex, Inc.

THE PROBLEM:

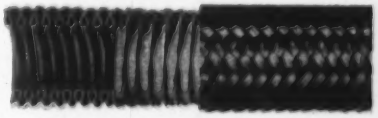
In a heating and air conditioning system, the temperature range of water and condensate varies over a 180°F. range. Some means were required to provide for expansion and contraction in the system without putting undue stress on rigid pipe and to confine the vibration to the compressors.

THE SOLUTION:

Use of new large-size (4", 5" and 6" I.D.) American Flexpipe – flexible bronze tubing assemblies complete with end fittings.

Flexpipe connectors – in standard sizes – can solve tough problems for you, too, wherever air, gas, oil, steam or water must be conveyed, because Flexpipe:

- Has extreme flexibility that lessens chances of breakage and leakage from expansion and contraction.
- Needs little maintenance attention.
- Dampens noise, absorbs vibration, takes up movement, solves misalignment problems.
- Cuts installation costs (does away with time and material costs of rigid conduit requiring elbows, couplings, short runs of pipe, etc.).
- Makes installations quick and easy –especially in cramped quarters.

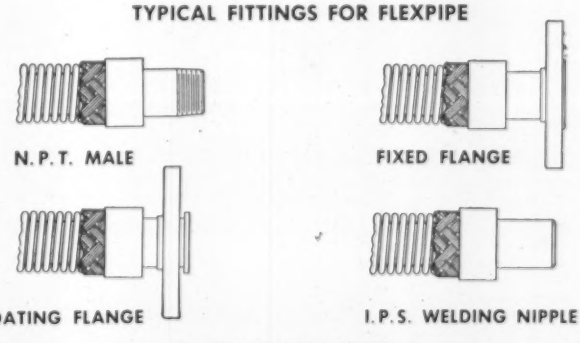


**CONSTRUCTION:** Inner hose corrugated for flexibility; wire braid over inner hose for added strength. Available in bronze, steel and stainless steel.

**WHERE TO BUY:**

Leading wholesaler distributors can provide you with information about Flexpipe in large sizes. These same distributors can show you samples and answer your questions about service applications for Flexpipe connectors in convenient standard sizes from ¾" up to 16" I.D. For the name and address of the distributor serving your area, or for more detailed information, write to: The American Brass Company, American Metal Hose Division, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

**TYPICAL FITTINGS FOR FLEXPIPE**




*(OTHER FITTINGS AVAILABLE)*

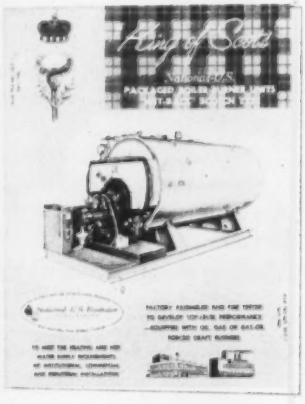
Flexpipe®

AN **ANACONDA®** PRODUCT

*Investigate the New "King of Scots" by National-U.S.*

Here's a *new*, completely packaged "wet-back" boiler-burner unit for commercial, industrial and institutional heating and hot water supply. It saves headroom . . . has a lower water line . . . needs no special foundation.

The boiler, burner and all controls are completely assembled and wired, and the unit is pre-tested at the factory. Result: rapid installation and check-out, and complete assurance of satisfaction as covered by the National-U.S. guarantee.




This new bulletin tells you everything you want to know about the *new* "King of Scots" by National-U.S. Send for it today; ask for form #989.

58-04

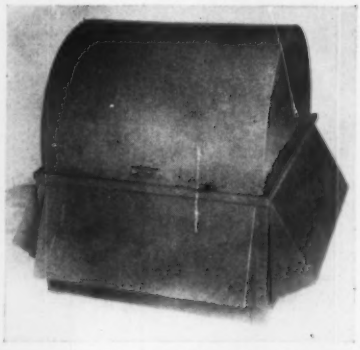
*National-U.S. Radiator*
CORPORATION
HEATING AND AIR CONDITIONING DIVISION
Johnstown, Pennsylvania

Sixty years in thermal hydronics


## EQUIPMENT DEVELOPMENTS

*Continued*

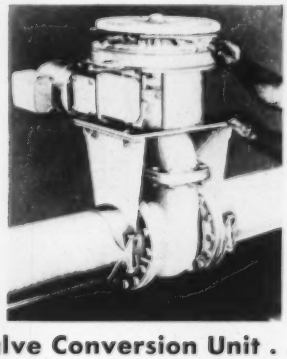
serving as prime water walls, combined with higher crown sheet height, eliminates need of dry base to develop adequate combustion area, says manufacturer. Available in sizes 4860 to 42,500 sq ft steam.



**Power Roof Exhauster . . .**

. . . with all steel construction and galvanized top, discharge hoods—*Greenheck Fan & Ventilator Corp., Dept. HPAC, Schofield, Wis.*

"Dallas Air Mover Series D" belt drive power exhauster available in sizes 300 to 27,000 cfm. Non-overloading, balanced centrifugal wheels are belt driven by ball bearing motors. Access to motor area facilitates installation, maintenance. Motor is isolated from exhausted air stream. Motor drive assembly, fan isolated from housing frame with vibration mountings.



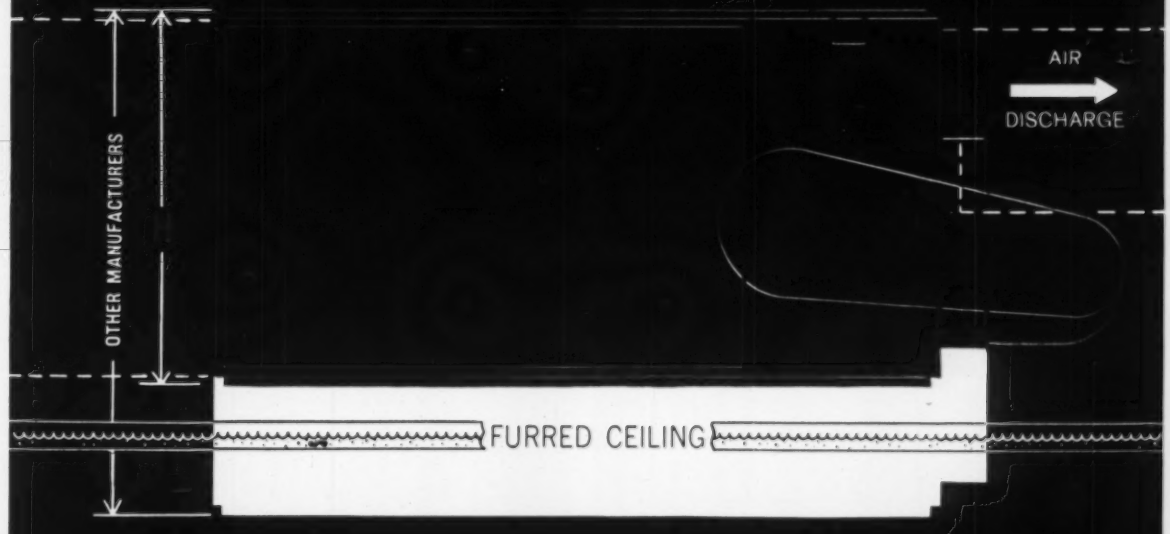
**Valve Conversion Unit . . .**

. . . designed to change over installed valves from hand operation to electric motor operation—*C. H. Wheeler Mfg. Co., Dept. HPAC, 19th and Lehigh Ave., Philadelphia 32.*

Unit can be installed in six steps

Now! Westinghouse offers

# low headroom air distributing units in six sizes . . . less than 28 inches in height




## Westinghouse Sizes

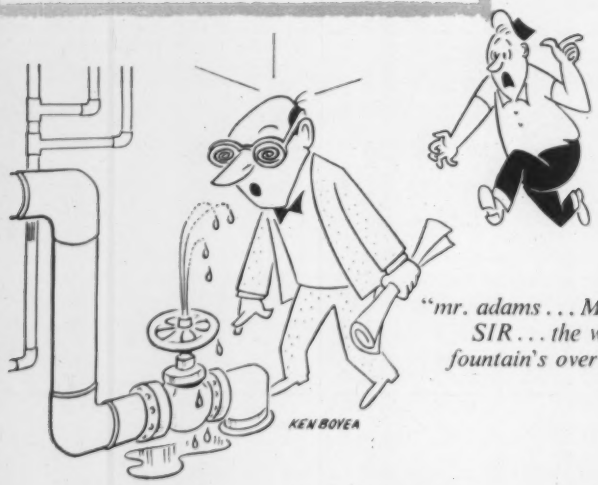
| (Height) | Coil Face Area Square Feet | Maximum Tonnage |
|---|---|---|
| 22" | 1.9 | 4 |
| 22" | 3.3 | 7 |
| 27" | 5.4 | 12 |
| 27½" | 8.0 | 18 |
| 27½" | 11.0 | 25 |
| 27½" | 16.0 | 36 |

**All Units Feature:**
**. . . Internal insulation**
**. . . Air activating finned coils**
**. . . Single equipment warranty**

Your Sturtevant Division sales engineer has complete information. Call him . . . or write Westinghouse Electric Corporation, Dept. G-2, Hyde Park, Boston 36, Massachusetts. J-80668

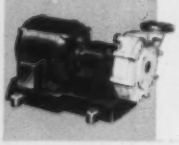
YOU CAN BE SURE...IF IT'S Westinghouse

## Life in these excited states...




*"mr. adams... Mr. Adams... SIR... the water fountain's over here!"*

**"WAM" PUMP**
*finest you can buy*

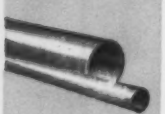


Highest pumping efficiency, with faultless corrosion resistance. Hard rubber casing and impeller; Hastelloy *C* shaft. 80 gpm. *Bul. CE-55.*

**THRIFTY-THROATED VALVES**

Liquids never touch metal in Ace-diaphragm valves! Rubber or plastic-lined cast iron, or solid plastic bodies. Sizes ½ to 6". Ask for facts.

**ACE-ITE**
*all-purpose toughie*

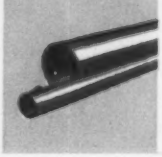


High-impact, rubber-plastic, most economical for average chemicals. ½ to 6". Screw or solvent welded fittings. Valves ½ to 2". NSF-approved. *Bul. 80A.*

## Why men of vision choose ACE equipment

Men with a weakness for profits somehow manage to keep equipment "on stream" full time with no corrosion shutdowns. You'll find they reach for Ace corrosion-engineered equipment time and again. Now nine kinds of Ace pipe ... plus pumps, valves, tanks, and special equipment to solve most any corrosion or contamination problem.

**RIVICLOR**
*ageless strength*



All-purpose rigid PVC. Sched. 40, 80 & 120, ½ to 4". Threaded or socket-weld fittings. Valves ½ to 2". NSF-approved. *Free Bul. CE-56.*

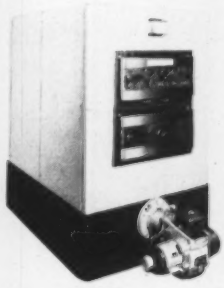
**ACE** processing equipment of rubber and plastics

**AMERICAN HARD RUBBER COMPANY**
DIVISION OF AMERACE CORPORATION
Ace Road • Butler, New Jersey


## EQUIPMENT DEVELOPMENTS

*Continued*

without special engineers, without disturbing piping or replacing existing valves, says manufacturer. "Valvmatic" can be used in applications where valve handle does not rise and where valve handle can rotate when valve is operating under power. In event of power failure, valve can be restored to manual operation. Position and torque limits provided in both directions of rotation to prevent valve injury. Unit can be moved from one valve to another without special wiring.



### Oil Fired Boiler . . .

. . . designed for commercial installations—*Weil-McLain Co., Dept. HPAC, Michigan City, Ind.*

"No. 82" oil fired boiler and oil heating unit rated with load range from 1300 to 3260 sq ft of steam and 2255 to 5290 sq ft of water. Features cited: two tankless or storage heaters with flexibility of heater arrangement; gas tight asbestos rope seal between sections; improved flueway design. Unit's construction is cast iron.

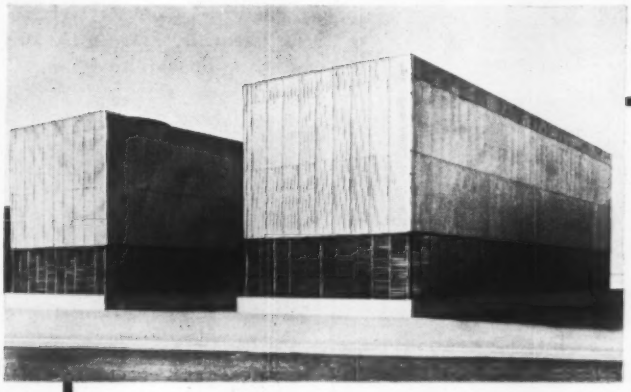
### Centrifugal Fans . . .

. . . designed to deliver up to 150,000 cfm at static pressures to 12 in.—*Dryer Electric Corp., Dept. HPAC,* 164-166 *Wallabout St., Brooklyn* 6, *N. Y.*

"TC" fans have been available in 20 sizes 9 to 60 in., capacities 150 to 100,000 cfm. New sizes: 66 in., with capacities to 110,000 cfm; 73 in., with capacities to 125,000 cfm; 86 in., with capacities to 150,000 cfm. Fans may be specified for class 1, 2, 3, or 4 service.

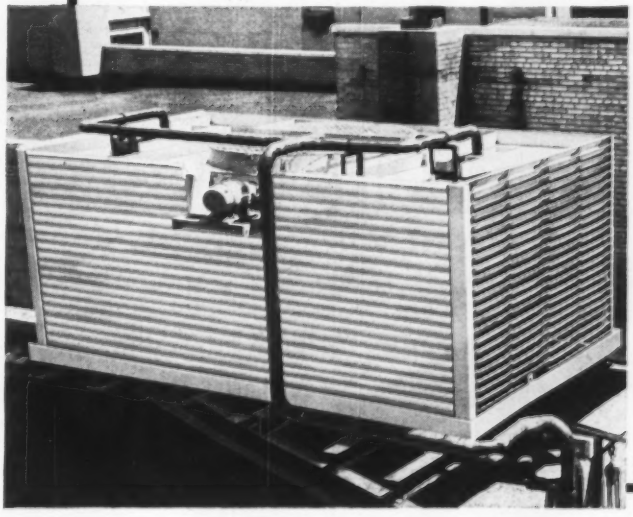
# HEADQUARTERS FOR COOLING TOWERS

## 150 TONS and UP



Tower on left is redwood framed Type WT with cement asbestos casing and louvers. Type WT towers are available from 500 tons and up.

Counterflow Type Towers available with either redwood or steel framing. Steel framing members are all hot dipped galvanized after fabrication in accordance with ASTM specifications. Partitions, louvers and siding of cement asbestos board are standard on this type of tower.



Series "DA" towers are available in California redwood, or Hot Dipped Galvanized framing. Corrugated cement asbestos board casing, laid horizontally, is fastened to frame with Galvanized bolts and Neoprene washers. Slipfit louvers of flat cement asbestos board provide easy access. All hardware is Hot Dipped Galvanized.

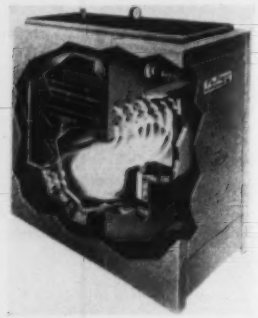
**SPECIAL FEATURES ON ALL TOWERS**

Corrosion Resistant Hardware. Aluminum or Stainless Steel Fans. Nailless Redwood Filling Removable at Tower Base. Nailless Three-Pass Redwood Eliminators. Removable Louvers.

Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N. Y.

## EQUIPMENT DEVELOPMENTS

*Continued*



### Hot Water Boiler . . .

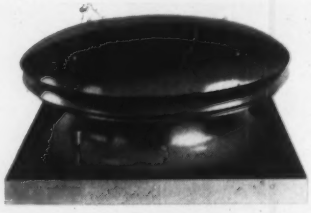
. . . in four new sizes—*Portmar Boiler Co., Dept. HPAC, 193 Seventh St., Brooklyn 15.*

Company's "Windsor" line now has 16 sizes with net steam ratings 320 to 5800 sq ft, net forced water ratings 580 to 9000 sq ft, produces 77,000 to 1,200,000 Btu per hr net steam, 87,000 to 1,350,000 Btu per hr forced water. Adaptable to oil or gas firing, is heavily insulated. Can be supplied with tankless coil for year 'round domestic hot water; insulated flush or extended jackets.

### Steam-Hydro Converter . .

. . . designed to eliminate accessory equipment—*Rowe A. Mauney, Dept. HPAC, P. O. Box 623, Marion, N. C.*

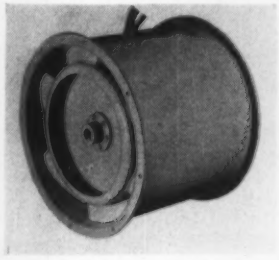
"Steam-Hydro Convertor" said to eliminate need for compression tank, water pressure regulating valve pressure relief valve, other accessories. May be installed above hot water radiation, supply and return lines, located remotely from boiler room. Based on 2 psi steam pressure; code construction and stamped 125 psi steam working pressure. Available in 50,000 and 250,000 Btu capacities.



### Axial Roof Ventilator . . .

. . . engineered for economical exhaust or clean air supply—*Trane Co., Dept. HPAC, La Crosse, Wis.*

Ventilators offered in three models: hooded unit for exhaust; hooded unit for air supply; vertical exhaust unit for high velocity discharge of smoke, fume and gas-contaminated air. Each of three models is available with direct or belt-drive in five fan wheel diameter sizes 24 to 48 in. Capacities range to 43,200 cfm and static pressure to 3/4 in.



### Vaneaxial Fans . . .

. . . intended for electronic equipment cooling, other fan applications where space is critical—*American-Standard, American Blower Div., Dept. HPAC, Detroit 32.*

Vaneaxial fans furnished in variety of housing shapes, sizes, flange


Everybody NEEDS THIS NEW REED CHAIN WRENCH

Ratchet action works either way from either side

IDEAL FOR CLOSE QUARTERS

*works where an ordinary pipe wrench won't!*

The Reed DU-ALL Chain Wrench does everything a conventional pipe wrench will do, and a great deal more. It gets into tight corners, close to baseboards or between parallel pipe lines, and holds round, square or irregular shapes . . . firmly, without "play" or crushing.

Its fast, ratchet action lets you tighten and "back off" without taking the wrench from the pipe.

All sizes of the DU-ALL wrench have ample chain length for fully tightening pipe up to the diameters handled by ordinary wrenches of equal lengths. Additional chain in the 14″ model, however, gives the wrench a full working capacity up to 2″ pipe and a holding capacity up to 4 inches. This is a major convenience in lining up soil pipe stacks, straightening studs, setting posts or turning any irregular shape within the leverage range of the 14″ handle.

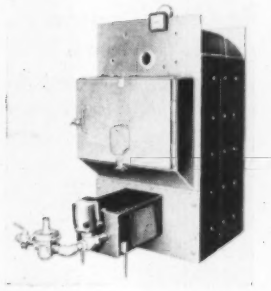
*Whenever you want to work with pipe . . . ask for a REED Pipe Tool!*

REED MFG. CO.

## EQUIPMENT DEVELOPMENTS

*Continued*

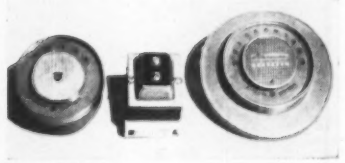
designs, finishes, mounting arrangements. Can be designed to meet military specifications. Line includes single-stage, two-stage units. All direct-drive with integral electric motor.



### Gas Boilers . . .

. . . redesigned to include horizontal tube, extended water leg construction—*Portmar Boiler Co., Inc., Dept. HPAC, 193 Seventh St., New York.*

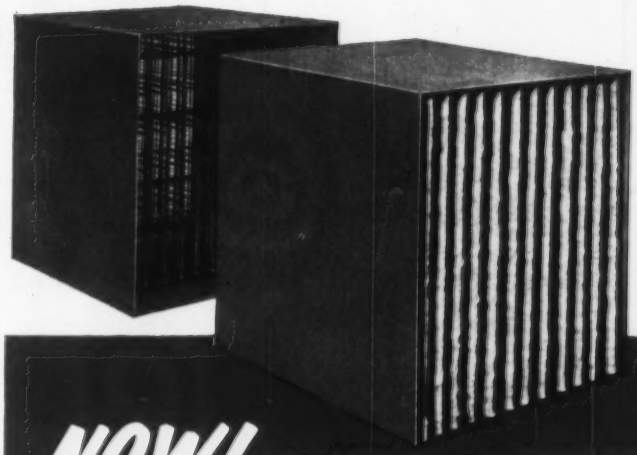
"HGU Commodore Series" eliminates need for field construction of combustion chamber, owing to one piece construction, says manufacturer. Burner and controls are completely enclosed. Available in 15 sizes with net steam ratings 400 to 5000 sq ft., net forced water ratings are 720 to 9000 sq ft.



### Control System . . .

. . . designed for regulating room temperature in advance of outside temperature changes—*General Controls Co., Dept. HPAC, 801 Allen Ave., Glendale, Calif.*

"Thermoramic Control" is a thermal-electric, three unit package with no moving or wearing parts. Can be installed with any new automatic heating system and requires no maintenance, says manufacturer. System includes: outdoor thermostat; indoor thermostat; 24 volt, 60 cycle transformer supplying operating electric current.

**NOW! Cambridge AEROSOLVE® Filters Available in HIGH VELOCITY MODELS!**

**80% More Air per sq. ft. face area**

**45% Less Area per given cfm.**

***. . . at No Increase in Pressure Drop***

Already famous for its low owning and operating cost, the Cambridge AEROSOLVE Filter in the new high-velocity models offers even greater economies. Compare:

| | High-Velocity AEROSOLVE | Standard AEROSOLVE |
|---|---|---|
| Rated Capacity (24" x 24" face area) | 1800 cfm. | 1000 cfm. |
| Face Velocity | 450 fpm. | 250 fpm. |
| Area of Filter Medium | 86 sq. ft. | 43 sq. ft. |
| Ratio, Filter Area to Face Area | 21.50 to 1 | 10.75 to 1 |

**Choice of 3 Efficiencies**

High-velocity AEROSOLVE cartridges are, like the Standard models, available in efficiencies of approximately 95%, 85% and 35% (discoloration test with atmospheric dust). All cartridges are interchangeable and are easily secured in permanent cadmium-plated frames by quick-acting fasteners at the corners. No other strainer-type air filter of comparable efficiency approaches the low pressure drop of these units.

Other than infrequent cartridge changes, AEROSOLVE filters require no maintenance. Installation is also low in cost. In high-velocity systems, the new units obviate the need of V-ing the filter bank and result in even greater installation and maintenance economies.

***Write for Bulletin 130***

**Cambridge Filter Corporation**

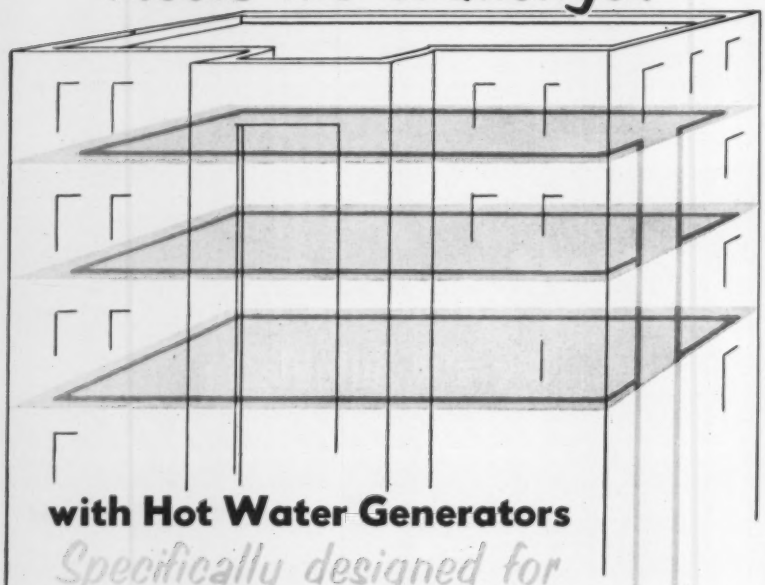
**732 E. Erie Blvd., Syracuse 3, N. Y.**

**Makers of the ABSOLUTE® Filter— World's Most Efficient Air Cleaning Device**

**REPRESENTATIVES IN PRINCIPAL CITIES**

# CYCLOTHERM

## meets the challenge!



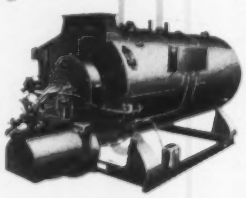
## with Hot Water Generators

*Specifically designed for*

## Forced Circulation Systems

Cyclotherm has designed a complete new line of Hot Water Generators built specifically to meet the requirements of forced circulation hot water systems. These Generators distribute water evenly throughout the length of the pressure vessel. Every drop of water contacts an effective heating surface. No short circuits! No trapped areas! No uncontrolled temperatures! *Only* Cyclotherm offers a complete line of Hot Water Generators built for forced circulation systems.

Cyclotherm Generators are shipped ready-to-work, with one manufacturing responsibility back of the entire equipment. No foundation, no excavation, no costly stack. Burning oil, gas and a combination of oil and/or gas, Cyclotherm gives fuel economy. Electronic controls make operation automatic. Maintenance costs cut up to 50%. Capacities from 670,000 BTU per hr. to 6,700,000 BTU per hr. Cyclotherm's world-wide service organization is always at your disposal. For full information, write today.



YEARS AHEAD IN STEAM & HOT WATER GENERATION

CYCLOTHERM®

Steam & Hot Water Generators

Cyclotherm Division National-U.S. Radiator Corp.

55 E. First St., Oswego, N. Y.

**Clip to your letterhead**

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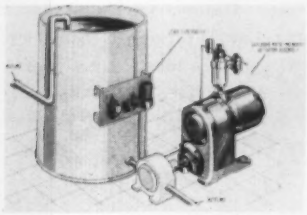
Please send me your new folder: "For The First Time . . . Package Boiler Economy for Modern Hot Water Systems."


## EQUIPMENT DEVELOPMENTS

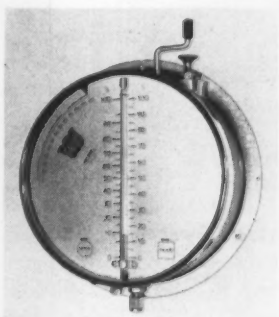
*Continued*



### Liquid Level Control . . .

. . . developed to maintain constant level in tanks such as used in food, chemical processing industries—*U. S. Electrical Motors, Inc., Dept. HPAC, Box 2058 Terminal Annex, Los Angeles 54.*

System consists of "Varidrive" motor equipped with "Varitrol" actuator. Motor provides variable speed to pump to maintain constant level within tank. System is entirely pneumatic, contains no floats or flow restricting valves. System provides two methods of controlling liquid level in open tank—air purge and liquid purge. Air purge method, using bubbler tube, for use with water other uniform liquids of low viscosity. Liquid purge method, using trickle flow of purge liquid, is used with higher viscosity liquids.



### Liquid Level Gage . . .

. . . developed for different diam, heights of above or underground storage tanks with wide range of liquids—*Robert Barclay, Inc., Dept. HPAC, 1234 W. Fulton St., Chicago.*

Chart is furnished with each gage, showing correct setting of indicator for tank height and specific gravity. Knob at bottom sets indicator. Gage has mercury column in 8 in. diam face.

# POWELL

## world's largest family of valves

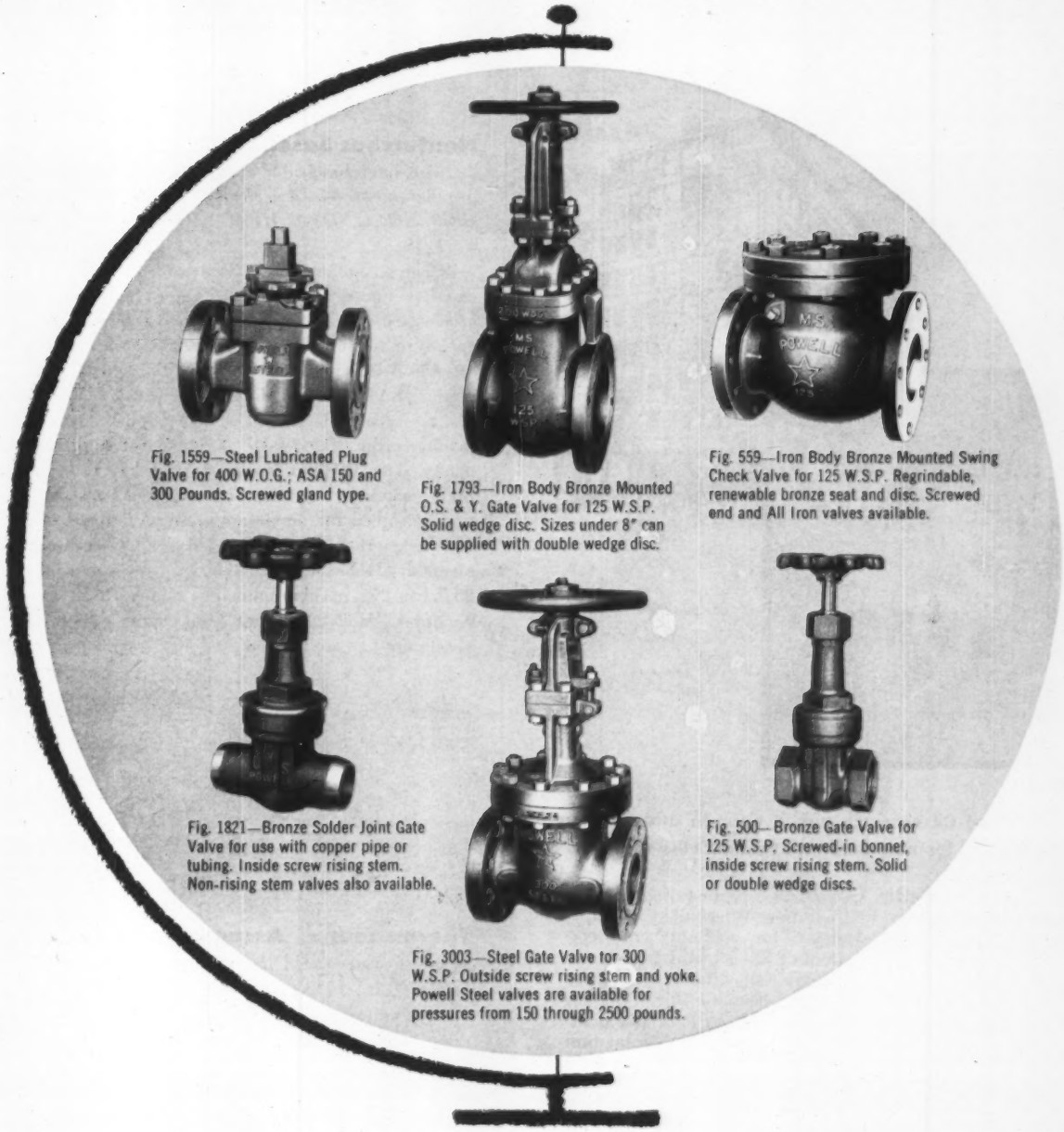


Fig. 1559—Steel Lubricated Plug Valve for 400 W.O.G.; ASA 150 and 300 Pounds. Screwed gland type.

Fig. 1793—Iron Body Bronze Mounted O.S. & Y. Gate Valve for 125 W.S.P. Solid wedge disc. Sizes under 8" can be supplied with double wedge disc.

Fig. 559—Iron Body Bronze Mounted Swing Check Valve for 125 W.S.P. Regrindable, renewable bronze seat and disc. Screwed end and All Iron valves available.

Fig. 1821—Bronze Solder Joint Gate Valve for use with copper pipe or tubing. Inside screw rising stem. Non-rising stem valves also available.

Fig. 3003—Steel Gate Valve for 300 W.S.P. Outside screw rising stem and yoke. Powell Steel valves are available for pressures from 150 through 2500 pounds.

Fig. 500—Bronze Gate Valve for 125 W.S.P. Screwed-in bonnet, inside screw rising stem. Solid or double wedge discs.

**FOR EVERY FLOW CONTROL PROBLEM** Powell offers more kinds or types of valves, available in the largest variety of metals and alloys, to handle every flow control requirement. Your local valve distributor will be glad to tell you all about them. Or write to us for the full facts.

**THE WM. POWELL COMPANY** • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**

# HEV-E-OIL burners
# HEV-E-DUTY gas burners

**preferred throughout the world**

In new installations and replacements, users of Hev-E-Oil and Hev-E-Duty Gas Burners the world over report significant reduction in costs plus better performance.

Boiler room of Berlin "Life" has three Hev-E-Oil Burners.

Complete line of burners is built in 8 sizes . . . 5 to 150 gph capacities . . . for boilers up to 500 hp.

**Hev-E-Oil economy picked over 16 other burners for new Berlin Life Insurance Building**

When Berlin Life Insurance installed Hev-E-Oil Burners in their new Wiesbaden office, it was another decision for economy and efficiency . . . more proof of the growing preference everywhere for Hev-E-Oil and Hev-E-Duty Gas Burners. Growing because they do offer the most practical approach to lowering heating costs. And because Industrial Combustion Burner design and dependability stand out in any comparison of heating systems. To find out how you can profit from this high heating efficiency, write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wisconsin, Dept. HPA-7.

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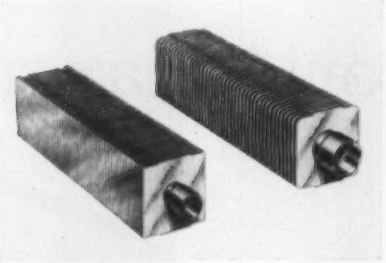
EXECUTIVE OFFICE: 4507 N. OAKLAND AVENUE, MILWAUKEE 11, WISCONSIN


## EQUIPMENT DEVELOPMENTS

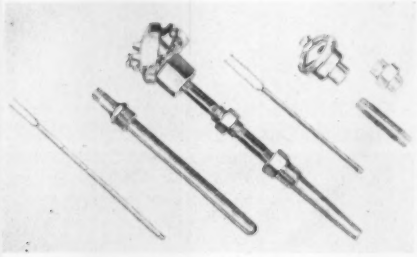
*Continued*



### Nonferrous Baseboard . . .

. . . with interchangeable components to suit variety of installation needs—*American-Standard Plumbing and Heating Div., Dept. HPAC, 40 W. 40th St., New York* 18.

"Heatrim" offered in two enclosures, with two high capacity finned-tube elements and complete matching accessories in new line. "Model L" is low, 8 in. steel enclosure for installations in height restricted areas; extends 3 in. from wall, may be recessed to depth of plaster. Enclosure has slide cradle which allows noiseless movement of element as it expands, according to manufacturer. "Model H" designed for high heat capacity. The 10¼ in. enclosure also has slide cradle. Both enclosures have one piece top and back construction, designed for maximum rigidity; offered in 4, 5, 6, 8 ft lengths. "Model 85," "Model 110" heating elements available for installation with enclosures, "Model 85," has 2⅝ in. aluminum fins bonded to ¾ in. copper tube. "Model 110" has 1 in. copper tube to which aluminum fins are bonded.



### Thermocouple Assemblies . . .

. . . in new, expanded line—*Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

Assemblies consist of standard wire-type and "Ceramo" thermocouples, connection heads, thermowells, fittings, mounting attachments. Thermocouples of "Ceramo" line are ceramic insulated, metal-sheathed; wire-type thermocouples have glass fiber or ceramic bead insulation. Copper-constantan, iron-constantan, chromel-alumel materials cover temperature ranges from −300 to 2200 F. "T-E" connection heads in six different types, including cast iron heads, aluminum heads with steel covers, quick-opening aluminum heads, 7 oz aluminum heads. All heads available with connections.

*proved by controlled laboratory test*

# stronger

## than standard or extra strength clay pipe

Just how permanent is a Therm-O-Tile installation may be gauged from Therm-O-Tile's strength. For Therm-O-Tile is **extra** strong — actually stronger than extra strength clay pipe! Substantiating this claim are the results of exacting tests conducted under rigid laboratory conditions by an independent testing laboratory. Write for complete strength-test data.

*Therm-O-Tile*

**conduit system**
FOR UNDERGROUND PIPING

H. W. PORTER CO., INC. — NEWARK 12, NEW JERSEY
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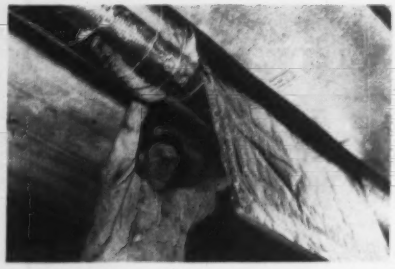
## Why Is RIDGID The World's Most Popular Pipe Wrench

...*because* it was a better pipe wrench when first created 35 years ago, and has been improved nearly every year since . . . in performance, design, materials. Today, it is still the most for your money. Buy RIDGID at your Supply House.

**The Ridge Tool Company, Elyria, Ohio, U.S.A.**

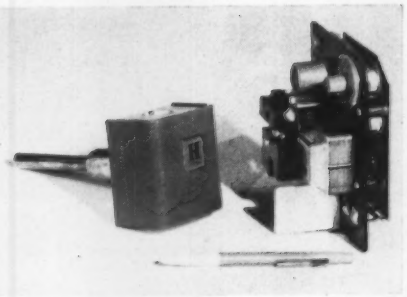
## EQUIPMENT DEVELOPMENTS *Continued*



### Duct Insulation . . .

. . . designed for external application on all concealed ducts, exposed round ducts carrying cold air—*Owens-Corning Fiberglas Corp., Dept. HPAC, National Bank Bldg., Toledo* 1.

Insulation acts as fine-fibered, inorganic, glass blanket; can be applied rapidly because of light weight and flange included for sealing joints. Foil facing provides vapor barrier. Minimum densities range from ½ to 1 lb per cu ft; moisture absorption less than 2 percent by weight. Product is odorless, does not sustain or promote bacteria, fungus growth. Thermal conductivity is 0.253 to 0.290 at 75 F. Thicknesses ½ to 2 in., widths are 24, 36, 48 in., lengths 100, 50 ft. Available with various vinyl and kraft paper facings.



### Temperature Control . . .

. . . developed for remote control of temperatures in industrial applications—*Minneapolis-Honeywell Regulator Co., Control Device Div., Dept. HPAC, 2747 Fourth Ave., S., Minneapolis.*

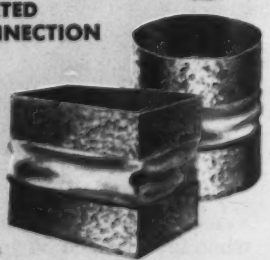
System consists of transistorized amplifier which serves as temperature controller, vibrationproof mounting containing thermistor acting as sensing element. Thermistor mounting and amplifier relay can be located up to two miles apart. Mountings for thermistors available in variety of sizes, shapes. May be obtained as small as 3/32 in. diam by 2 in. long. System may be used to control air, surface or immersion temperatures. Amplifier relays available in overlapping ranges of approximately 100 F to permit control from —60 to 520 F. Control point shifts less than 1 deg for every 70 deg change in ambient temperature.


Another CAIN COIL OF PROFIT

PRE-FAB-RIC

A PREFABRICATED FLEXIBLE DUCT CONNECTION

Simply pull out desired length from dispenser-type carton. (It pulls out ready to use.) Roll into round duct or form into square duct and join. Saves 70% time over old methods. DOUBLE-SAFE-LOCKED



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THREE FABRICS Canvas - Asbestos Neoprene

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Seal water, gas, and low-pressure lines positively with KEY-TITE.

**New Improved Formula** contains special ingredients that increase pliability and open-can life.

**Easy to Apply**—goes on with a brush.

**Easy to Break**—can't freeze joints.

***Order KEY-TITE from your local supply house or write for FREE SAMPLE to try on your next job.***

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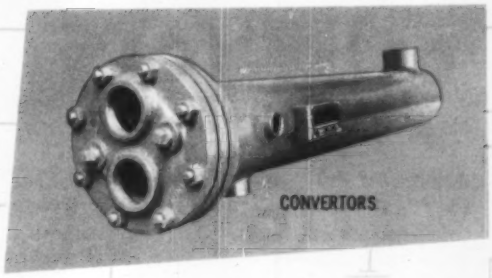
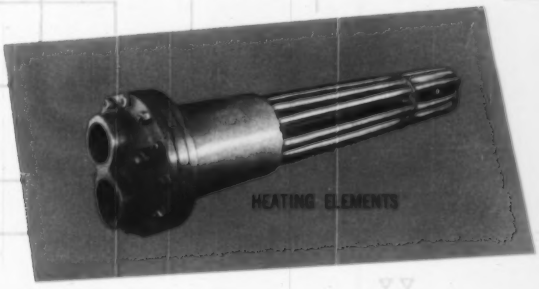
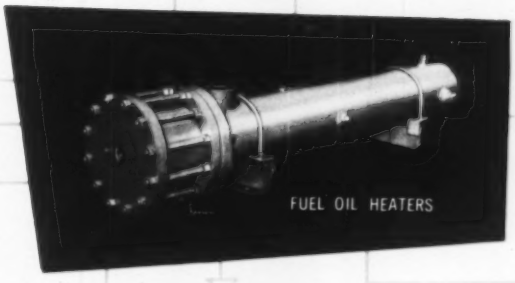
DIVISION OF acf INDUSTRIES INCORPORATED
Dept. BB-7, P. O. Box 2117, Houston, Texas

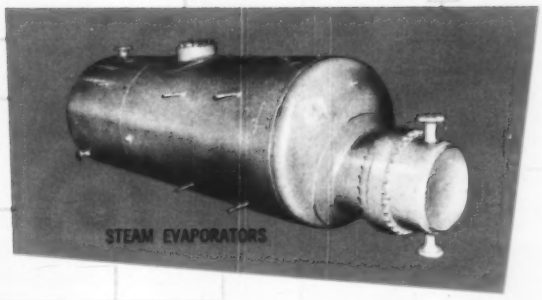
# Paracoil Heat Transfer Equipment

# puts HIGH TEMPERATURE HOT WATER to work




Over the years, Paracoil Heat Transfer Equipment has been answering the needs of industry by converting efficiently distributed high temperature hot water to effective local use at serviceable temperatures and pressures.

The Davis Engineering Corporation has pioneered equipment specially designed to make HTHW a practical heat transfer medium. Here are just some of the Paracoil products specified by Consulting Engineers for various service applications.

PARACOIL CONVERTORS FOR:

**Space Heating** — radiators, radiant heating panels, etc.

**Process Heating** — vulcanizers, kettles, plastic rolls and platens.

**Miscellaneous Heating** — snow melting systems, domestic water in storage tanks, electroplating tanks, roof tank heating coils, and wherever hot water is the heating medium.

PARACOIL HEATING ELEMENTS FOR:

**Hot Water Storage Tanks** — installed in office buildings, laundries, schools, gymnasiums, factories, hospitals, etc.

PARACOIL STEAM EVAPORATORS FOR:

spot process application, cooking equipment, sterilizers, calender rolls, etc.

PARACOIL FUEL OIL PREHEATING SYSTEMS:

designed to eliminate contamination through isolation of HTHW from the fuel oil.

**DAVIS ENGINEERING CORPORATION**

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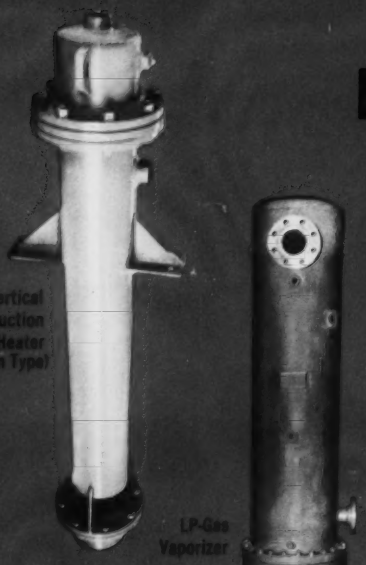
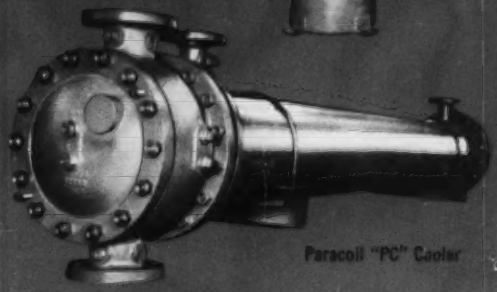
# Davis Engineering Corporation builds a complete line of Heat Exchangers for industrial and process applications

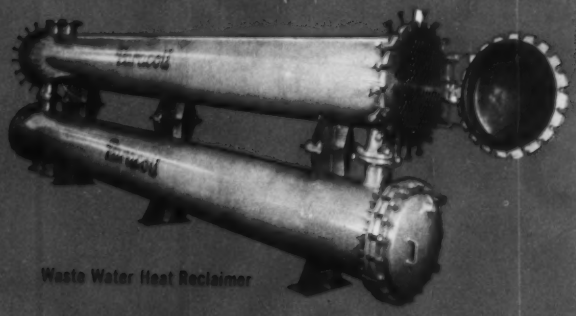


Vertical Tank Suction Fuel Oil Heater (Steam Type)

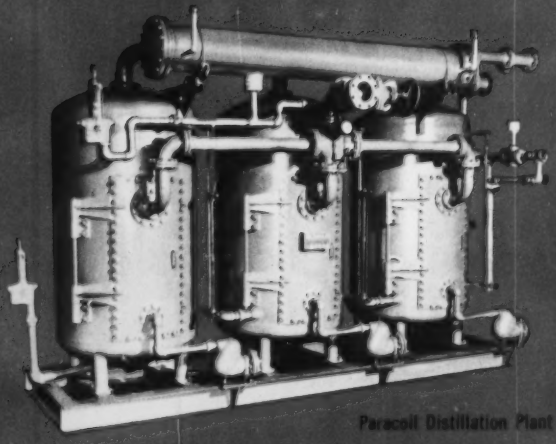
LP-Gas Vaporizer



Paracoil "PC" Cooler



Waste Water Heat Reclaimer



Paracoil Distillation Plant

**air heaters and coolers**

**blowdown exchangers**

**brine heaters and coolers**

**boiler coils**

**chemical process equipment**

**condensers**
freon, reflux, steam, solvent, vent

**converters**
steam-to-water
water-to-steam

**coolers, refrigeration**
brine, freon

**coolers, industrial**
condensate, jacket water
lube oil, quenching oil
boiler-water sample, drain

**distilling plants**
fresh water; salt water

**economizers**

**evaporators**
freon, water distilling, boiler-feed water make-up, contaminated water, fresh-water, salt-water

**extractors**
grease, boiler feedwater

**filters**
aerating, distilled water, charcoal, feedwater

**flexible nipples**

**float feed controls**

**fuel oil heaters**
indirect gas-fired Type "GF"
THERMO-FILM safety type
self-cleaning type
straight tube type
suction bell
tank suction type
tubular type
U-tube type

**gas heaters and coolers**

**heating elements**

**heat reclaimers**
open & closed types, laundry

**heaters, domestic water**
indirect and tankless

**heaters, exhaust gas**

**heaters, feedwater**
coil type, standard and improved
straight and U-tube types

**heaters, storage tank**

**heaters, general**
acid, alcohol, alkali, water, solvent, process, etc.

**instantaneous water heaters**

**inspection tanks**

**jacket water coolers**

**lube oil heaters and coolers**

**pilot plant equipment**

**preheaters and reclaimers**
for reclamation of heat from hot spent liquids

**propane vaporizers**

**reboilers**

**refrigeration exchangers**
condensers, coolers, evaporators, receivers

**stills**
for distillation of sea, river, lake or spring water

**traps, steam**

**valves**
cross & 3-way high pressure
exhaust gas by-pass
three-way swing type

**vent condensers**

**waste-heat exchangers**

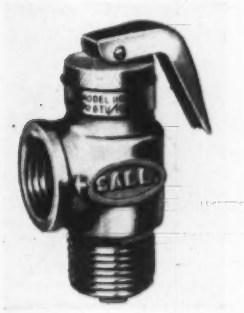
**white-water heaters**

## DAVIS ENGINEERING CORPORATION

30 Rockefeller Plaza, New York 20, New York • Circle 6-5650

## EQUIPMENT DEVELOPMENTS

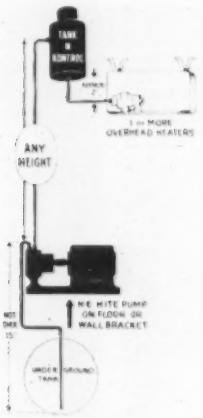
*Continued*



### Poppet Valve . . .

. . . for hot water heaters and storage tanks—*Sall Bros. Co., Dept. HPAC, 2320 Kishwaukee St., Rockford, Ill.*

"Series 110" has all bronze cast body, stainless steel compression spring, synthetic seat which automatically seals as it resets, ½ in. male inlet and ½ in. female discharge connections. Available in pressure and pressure-temperature models. Pressure-temperature models are rated 115,000 and 150,000 Btu per hr. Standard factory setting is 120 lb pressure. Fuse plug melts at 210 F; one extra plug supplied with each valve. Valve also available in pressure settings 85 and 150 lb with 200 F or 210 F temperatures.




### Fuel Oil Pump . . .

. . . for raising oil to overhead heaters—*N. E. Hite Mfg., Co., Dept. HPAC, 303 N. Elizabeth St., Chicago.*

Operation of unit governed automatically by two heavy duty mercury switches which control two sets of floats. Main set of floats maintains level of oil in feed tank, automatically stops pump if oil feed line is broken or if tank runs dry. Separate set of floats stops pump in case main set fails to cut off at high level. No return line required. Pump is self-priming, no overflow line necessary from feed tank.

### Sealed Motor . . .

. . . with silicone rubber insulation rated for "Class B" temperature rise —*Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee.*

Insulating wall on "Super Seal" rotors is moistureproof, says manufacturer. Also said to be resistant to oils and corrosive chemicals found in many industrial applications. "Silco-Flex" insulation is thermally stable beyond normal operating range. Recommended for use in chemical, paper, petroleum, metals, rock products fields, wherever moisture, heat, dirt, dust, other contaminants are problem.


# Your ideas work better when you work with HONEYWELL

The following pages bring you the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

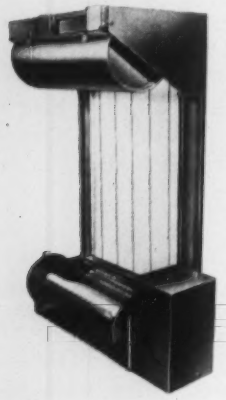
For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 offices throughout the country; each is staffed with capable control specialists to assist you in preparing proposals and writing specifications.

Look over these new products and systems. And, remember, they are backed by the kind of support only Honeywell can offer you.

FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

## EQUIPMENT DEVELOPMENTS

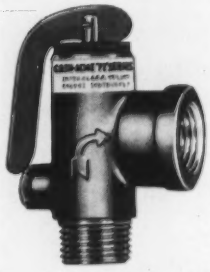
*Continued*



### Air Filter . . .

. . . in automatic renewable-media design—*American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

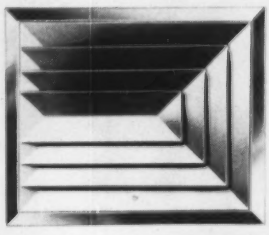
"Roll-O-Matic Model B" filter unit has reinforced media with an adhesive which will not run in high temperatures, thicken in low temperatures, lose adhesiveness due to dryness, says company. Features: galvanized construction; media supports which add structural strength to frame; improved drive located on service side of unit, serve as many as six units; maximum use of effective filtering area; 12 months supply of filtering media in 65 ft roll. Available in vertical sections of 3, 4, 5 ft. heights 5 to 15 ft, by 4 in. increments. Filter equipped with built-in runout switch which provides warning when end of supply roll has been reached.



### Relief Valves . . .

. . . designed to facilitate plug replacement without removing or disconnecting valve—*Cash-Acme Co., Dept. HPAC, P.O. Box 191, Decatur, Ill.*

"Type F-2T" pressure temperature relief valves are of all bronze construction. Available with or without test levers, in ½ or ¾ in. male inlet connections.



### Air Diffusers . . .

. . . with built-in vane and louver arrangements designed to provide versatility, air diffusion efficiency without baffles, blank-offs—*Titus Mfg. Co., Dept. HPAC, Box 310, Hiway 20, Waterloo, Iowa.*

"Series TMD" diffusers available in variety of air patterns to suit space condition. Two basic types include: one piece units and two piece units with choice of mounting frames and interchangeable cores. Also available


FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

*For your mechanical systems... Honeywell Hi Velocity Double-Duct Mixing Box Controls*

**Now your choice of two constant volume systems**

**1.** Honeywell's Volumatic* system gives clients dependable, economical, constant volume control of double-duct systems. This control system uses piston motors with nylon bearings which require less lubrication and a sensitive pressure regulator. It can be applied to all sizes and types of mixing boxes.

**2.** Honeywell's Duablend* system gives your clients superior performance and minimum maintenance. Better performance is secured by using *two* pressure regulators to assure constant volume from *each* duct (under control of space thermostat) regardless of pressure changes. Its exclusive Sub-master pressure regulator provides a similar stabilizing control action to the Sub-master duct thermostat in heating and ventilating units.

For minimum maintenance, the Duablend† system uses the simple Honeywell Air-Balance Valves*. These valves have no mechanical parts to wear and no adjustments. The valves operate on the balance of air pressure on two sides of a flexible diaphragm.

*Trademark

†Duablend formerly termed Air Blender

**Honeywell**

First in Controls

## EQUIPMENT DEVELOPMENTS

*Continued*

are "TCMDR" combination supply and return diffusers furnished in square or rectangular styles with same directional, pattern control as other diffusers. Complete line of accessories includes "AG-95" opposed blade dampers, "AG-125 Dua-Trols" with two sets of independently adjustable air deflecting blades.

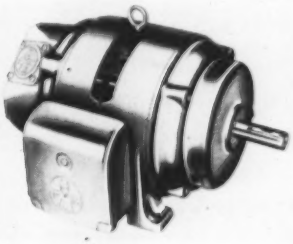
will reduce temperatures 20 to 50 deg F, will reduce load on air conditioning units to 12,000 Btu, equivalent to 1 ton. Contained in all aluminum rust resistant cap, which requires no painting. "Model D Flying Saucer" designed for installation in flat or sloping roofs, gable, wall or ceiling, available with or without automatic thermoswitch.

When motor gains speed, centrifugal switch cuts out capacitors for straight induction run. Switch has oversize snap action contacts, may be reached through access cover, replaced without disturbing motor. Type "WCZK" single-phase, 60 cycle, 115/230 volt motors available from $\frac{3}{4}$ to $1\frac{1}{2}$ hp at 1200 rpm, 1 to 3 hp at 1800 rpm, $1\frac{1}{2}$ to 5 hp at 3600 rpm.

**Power Ventilator . . .**

. . . for small commercial applications —*Triangle Engineering Co., Dept. HPAC, 1301 Ashland, Houston, Texas.*

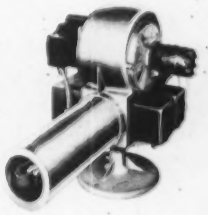
New 15 in. ventilator with direct drive fan, capable of continuous service, exhausts 1000 cfm. Ventilator

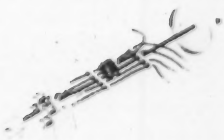


**Capacitor Motors . . .**

. . . designed to provide high starting torque, operating efficiency—*Fairbanks-Morse & Co., Dept. HPAC, 600 S. Michigan, Chicago 5.*

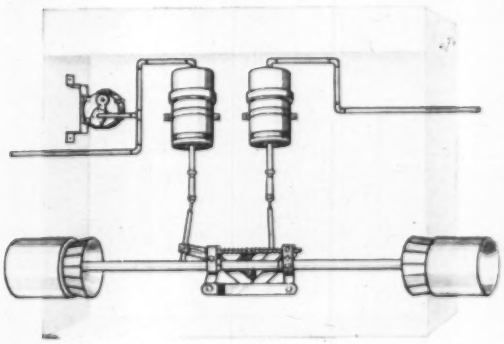
For starting, heavy duty induction run single phase integral hp motors use capacitors of dry electrolytic type.



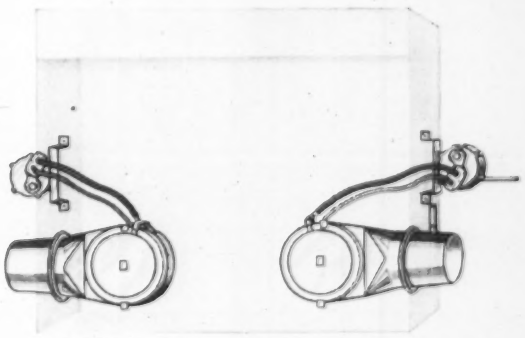


**Oil Burner . . .**

. . . designed for commercial, light industrial installations—*Wayne Home*



VOLUMATIC



DUABLEND

# Here's how these two dependable systems work

**Volumatic System:** 1) Space thermostat operates motor to change ratio of hot and cold air. 2) Pressure regulator in mixed air operates another motor to adjust linkage, increase or decrease total volume from both hot and cold ducts (as shown above). Or, (not shown) 1) Space thermostat operates motor to control hot duct valve. 2) Pressure regulator in mixed air operates motor to control cold duct valve, maintain constant total volume. This low cost system gives dependable control, is easy to maintain, fits all sizes and types of mixing boxes.

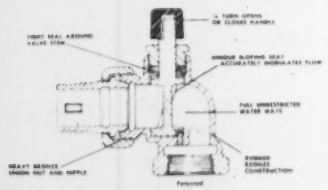
**Duablend System:** 1) Space thermostat resets Sub-master pressure regulator controlling valve in hot duct. 2) Pressure regulator in mixed air controls the total air volume by operating cold duct valve. 3) Change in flow resulting from changes in hot duct pressure is corrected by Sub-master regulator operating hot valve without disturbing cold. 4) A change in flow caused by changes in cold duct pressure is corrected by regulator controlling total flow which adjusts cold duct valve. Sub-master flow regulator holds hot duct flow constant.

## EQUIPMENT DEVELOPMENTS

*Continued*

*Equipment Co., Inc., Dept. HPAC, Fort Wayne, Ind.*

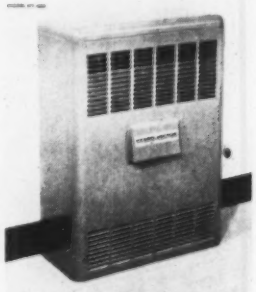
Electronically controlled 7 to 16 gph "Commercial" oil burner is intended for use with No. 2 or lighter fuel oils including 100 percent catalytic oils. Standard equipment includes "M-H Y222B" electronic controls. Equipped with dual transformers and ignition system, twin nozzle adapter. Motor is 1/3 hp, 60 cycle, 110 volt, capacitor type with jaw type coupling to fan and 2 stage fuel pump. Cast aluminum housing. Shipping weight is 185 lb.



### Balancing Fitting . . .

. . . with circulator valve—*Dunham-Bush, Inc., Dept. HPAC, 179 South St., West Hartford 10, Conn.*

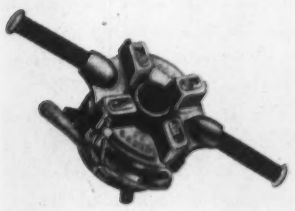
Using new fitting, water flow is said to be proportional to valve rotation. Circulator valves are applicable to forced water heating or cooling systems.



### Heating-Cooling Units . . .

. . . in new, integrated construction—*Hydrotherm, Inc., Dept. HPAC, Clinton Ave., Northvale, N. J.*

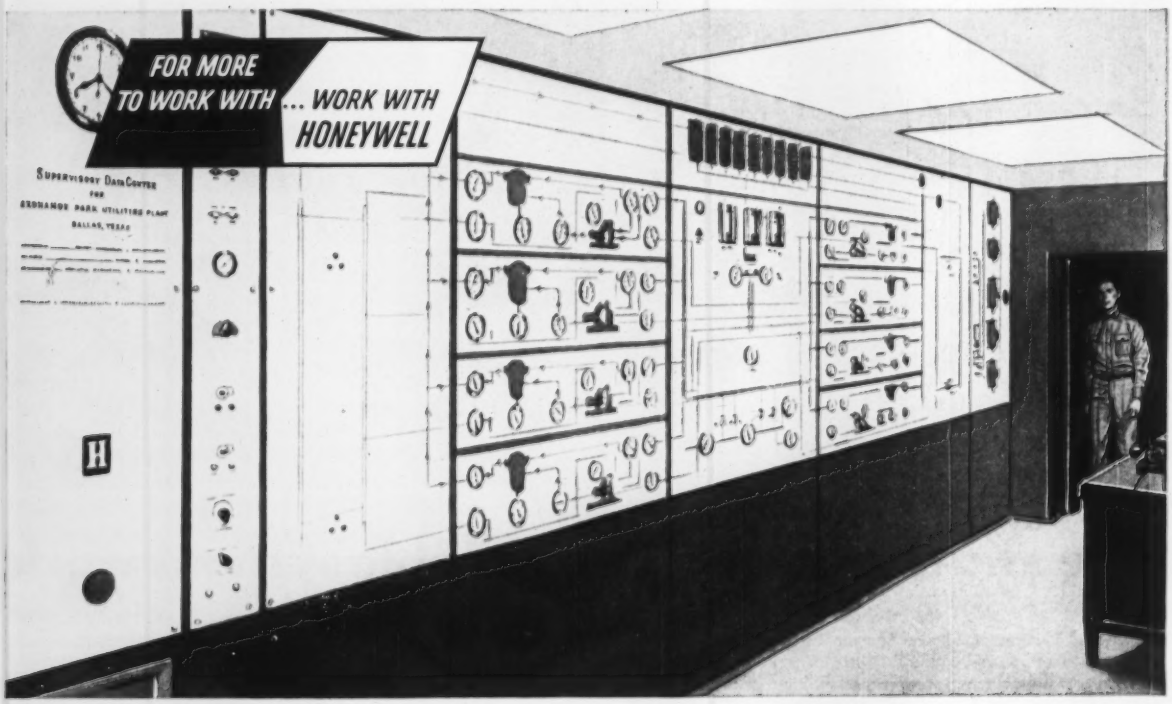
"Hydro-Vectors" are available in two sizes: "Model HY-400" is rated at 3950 Btu per hr with chilled water of 42 F average temperature; "Model HY-800" is rated at 8600 Btu per hr. Unit consists of copper coil heat exchanger and centrifugal fan with a filter, housed in steel cabinet.



### Pipe Thread Die Head . . .

. . . fully adjustable to cut oversize, undersize, standard threads—*Toledo Pipe Threading Machine Co., Dept. HPAC, 1445 Summit St., Toledo 4.*

Cam-type die head available in two sizes: "No. 44," $\frac{1}{8}$ to $\frac{3}{4}$ in. pipe, $\frac{1}{4}$ to $1\frac{1}{8}$ in. bolt; "No. 66," 1 to 2 in. pipe, $1\frac{1}{4}$ to 2 in. bolt. Back plate, body bolted together for maximum bearing surfaces for chasers. Gage makes possible setting for standard, over or undersize thread. Dies released instantly from completed thread, no slow backing off necessary, says manufacturer.

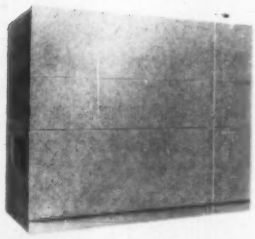





**The Supervisory DataCenter** for the Exchange Park Center in Dallas, Texas, provides an operational check on compressor and boiler pressures for the entire center which will eventually include 4 major office buildings, a department store, 150 retail stores, a thousand-room hotel, an auditorium and a medical center. Each component of the system is represented in miniature on the 30 foot panel. Owner: Wm. A. Blakely; Engineer: Blum & Guerrero; Architect: Lane, Gamble & Associates; General Contractor: J. E. Morgan & Sons; Mechanical Contractor: Kieffer Plumbing & Heating; Electrical Contractor: Fischbach & Moore.

## EQUIPMENT DEVELOPMENTS

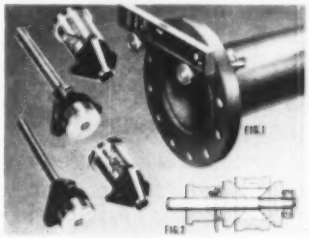
*Continued*



### Self-Contained Air Conditioners . . .

. . . with hermetically sealed compressors in 50, 60 ton models—*Typhoon Air Conditioning Co., Div. of Hupp Corp., Dept. HPAC, 505 Carroll St., Brooklyn* 15.

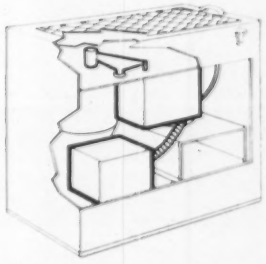
New water cooled air conditioners have all copper, tube-within-tube condensor design; oversize compressor capacity; automatic controls and safety devices; high capacity cooling coils; water, electrical connections said to simplify installation, servicing. Capacity of 50 ton model, 610,000 Btu per hr; 60 ton, 733,000 Btu per hr. Steam or hot water coils available for conversion to year 'round operation. Four discharge-return arrangements available: vertical discharge with rear return; vertical discharge with front return; front horizontal discharge with rear return; rear horizontal discharge with front return. The 50 ton model has five compressors with nominal capacity of 10 hp each, 60 ton model has six. Both units measure 120 in. wide, 103 in. high, 45 in. deep.



### Line-Up Pins . . .

. . . developed for cutting, welding jigs for pipeline and fabrication—*C. A. Mathey Machine Works, Inc., Dept. HPAC, P. O. Box 1159, Tulsa.*

Flange line-up pins installed in holes of flange to support spirit level so axis of bolt holes in flange are perfectly horizontal before welding flange to pipeline or piping fabrication. Cones of lineup pins automatically center pin in bolt hole, designed to fit properly even on raised-face flanges. For $\frac{1}{4}$ to $1\frac{3}{4}$ in. bolt holes.



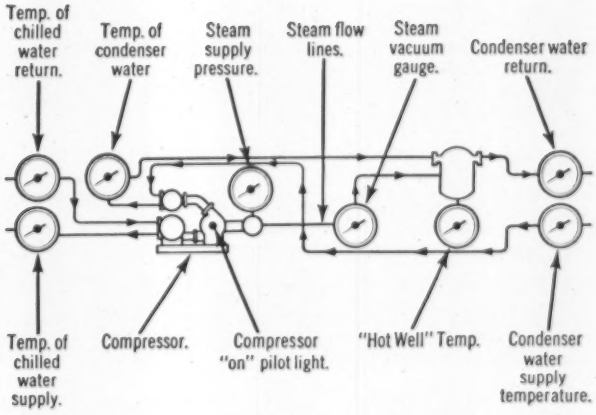
### Dust Collector Shaker . . .

. . . for installation with manufacturer's "Dustkop" air recirculating dust collectors, designed to reduce maintenance, replacement — *Aget Mfg. Co., Dept. HPAC, 1403 E. Church St., Adrian, Mich.*

Automatic shaker system has system of hammers within collectors. In


*Honeywell Supervisory DataCenter**

# Central supervision of air conditioning for a 120 acre park




One of eight steam-driven refrigeration compressor systems depicted in miniature on the DataCenter panel. Other modules on panel provide data on performance and operation of 9 cooling towers and 5 boilers, start-stop buttons and pilot lights for water pumps, temperature selector knob for the heat exchanger, pH meter for condenser water and several alarms, audible and visual.

*Trademark

The 30-foot Supervisory DataCenter panel for Exchange Park is installed in the Utilities Building. It enables the operating engineers to check on the operation of the steam turbine driven refrigeration compressors and boiler plant steam pressures that serve this entire project with steam and chilled water for their respective air conditioning systems. Pilot lights show which equipment is operating. Fluid pressures and temperatures are indicated continuously.

The added efficiency and savings which centralized control such as this offers building owners can be custom designed for your clients. Only Honeywell has the equipment, facilities and experience to develop special panels to suit all buildings. Honeywell Industrial instruments are precise and dependable. Honeywell panel manufacturing facilities are the largest in the control industry. And Honeywell has over 400 centralized control panels, of great variety in operation.

**Honeywell**

First in Controls

## EQUIPMENT DEVELOPMENTS

*Continued*

smaller capacity models single hammer is driven by heavy duty solenoid; hammers in multiple filter models are motor driven. Shaking action starts automatically when machine is shut off.

### Coal Bin . . .

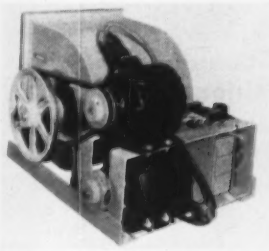
. . . developed to provide reliable flow of coal from bins without arching, ratholing, or funneling—*Fairmont Machinery Co., Dept. HPAC, Fairmont, W. Va.*

"Easy-Flo Bin" developed by Bituminous Coal Research, Inc., produced by manufacturer under nonexclusive license. Though developed for use with coal, bin can be used for other bulk solids such as sand, gravel, grain, chemicals, fuels, ores, pigments, metal powders, etc., either in a dry, semi-dry or moist condition. Bin is attached to bottom opening of conventional storage bin, provides means for controlling flow of coal or other bulk solid. Material is maintained in an unpacked state. Unit has gravity feed rate to 7000 lb per min.

### 4-Way Valve . . .

. . . designed for simple operation with no adjustment needed—*Circle Seal Products Co., Dept. HPAC, 21-81 E. Foothill Blvd., Pasadena, Calif.*

Four-port plug valve designed to connect adjacent ports alternately by 90 deg rotation of handle. Use of resilient o-rings fitted in specially machined grooves gives leakproof characteristic. Typical application of "P1-418" valves: cutting out, selecting columns required in chromatographic analysis systems. Can be used to backflush heavy components or slow moving parts of sample from columns. Recommended by manufacturer for use with helium, other gas test systems. Can be used as three-way valve by plugging one port.



### Vehicle Heater Fans . . .

. . . in three sizes—*American Blower, Div. of American-Standard, Dept. HPAC, Detroit 32.*

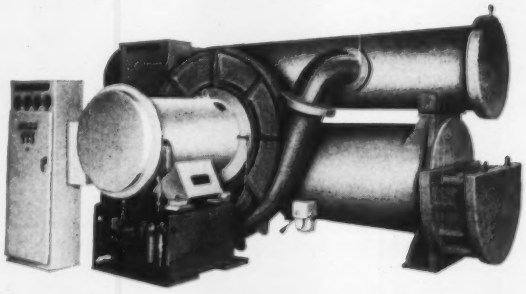
The first is a small blower designed for use as a truck cab heater. It has a totally enclosed 3450 rpm, 1/50 hp d-c drive motor with a 97 cfm capac-

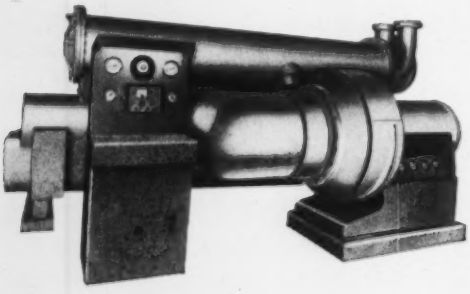

FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

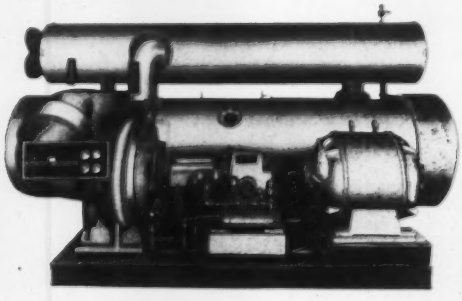
# Honeywell Electronic correction of centrifugal

**Leading manufacturers use Honeywell controls**

Note the free selection of panel location permitted by these Honeywell electronic controls as they are used by leading manufacturers. They hold the chilled water in these machines within plus or minus 1½°—often within plus or minus ½°. The system does not require a wide throttling range, therefore there is little offset from the control point. The motor load limiting system on these controls provides instantaneous correction of vane position.



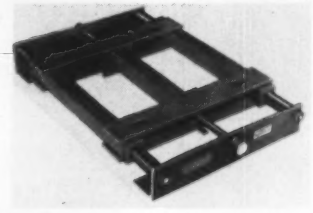




## EQUIPMENT DEVELOPMENTS

*Continued*

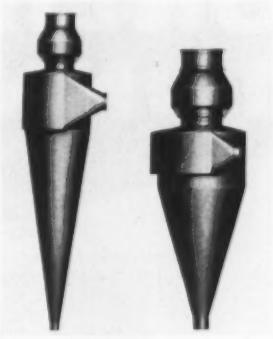
ity. The other two models are double air inlet, high volume blowers, suitable for v-belt drive. One of these is equipped with two motors: one a ½ hp, 208 volt, 3 phase, 400 cycle, a-c design, operating at 5600 rpm; the other a 1/6 hp, 24 volt d-c unit, operating at 3600 rpm. The third heater supply blower is made for a separately mounted drive motor and will deliver 1360 cfm at 2485 rpm.



### Motor Base . . .

. . . developed to maintain proper amount of tension in belts—*Automatic Motor Base Co., Dept. HPAC, Windsor, N.J.*

Tension effected by spring which compensates for considerable belt stretch before readjustment necessary. Readjustment can be made while operating under load by turning screw; initial pulley alignment maintained. Adaptable to applications where space is a premium; can be mounted in any position, says manufacturer. In sizes ¼ to 500 hp.



### Centrifugal Collectors . . .

. . . developed to cover wide range of industrial applications—*Kirk & Blum Mfg. Co., Dept. HPAC, 3100 Forrer St., Cincinnati 9.*

"Design 3" intended for shavings, sawdust, polishing, buffing, similar uses where dust size will run above 325 mesh (44 microns), but may contain small percentages down to 20 microns. Air inlets, dust outlets of sufficient size to handle stray bulk objects, says company. At standard air density and normal rating, collectors operate at 2 in. WG. Capacities 350 to 54,500 cfm available. "Design 5" dust collector equipped with relatively small diam, long cone, intended for dust sizes below 44 microns. Normally rated at 4 in. WG at standard air density. Only small diam units may be used in 5 to 10 micron range. Capacities 260 to 6500 cfm available.

### Plug Valve . . .

. . . operating on eccentric principle—*DeZurik Corp., Dept. HPAC, Sartell, Minn.*

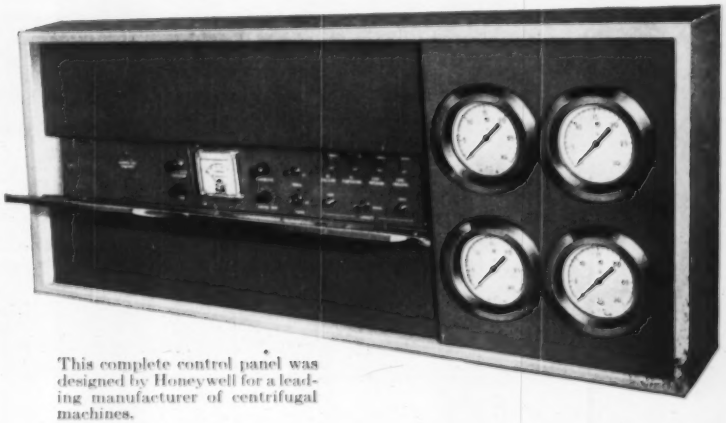
As eccentric valve begins to open, plug automatically backs away from seat and is not in contact with seat except in closed position, eliminating necessity of lubrication, says compa-


# Controls give accurate sensing, rapid refrigerating machines

This Honeywell Electronic Control System combines the functions of chilled water temperature control and motor load control. Its application to centrifugal refrigeration offers your clients these important advantages:

- Rapid, accurate control of chilled water temperature; instant, positive correction.
- Maximum input current can be set at any predetermined value by a simple adjustment of the load limiting switch.
- The simplest, most trouble-free control of temperature and motor current.
- Consolidates all equipment in one location, permits setup, adjustment and service from the central panel, keeps adjustments secure in a tamper-proof enclosure.
- Permits free selection of panel location—troublesome capillaries are eliminated.

For further information call your nearest Honeywell office. Or write Minneapolis-Honeywell, Department AC-7-103, Minneapolis 8, Minnesota.



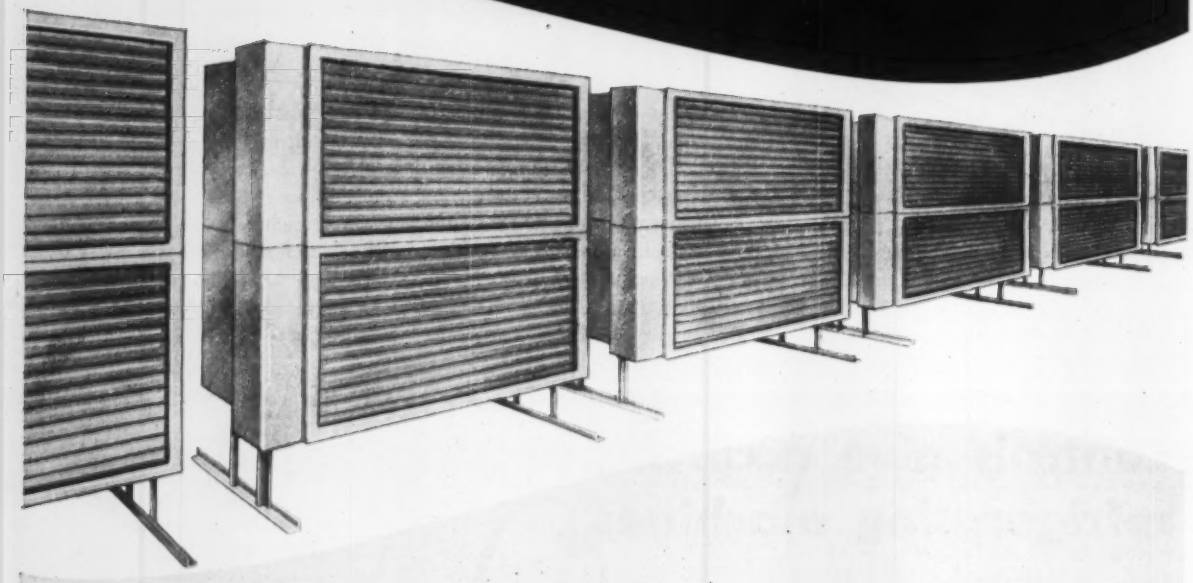
This complete control panel was designed by Honeywell for a leading manufacturer of centrifugal machines.

**Honeywell**

First in Controls

KRAMER

# UNICON for UNLIMITED TONNAGE



Kramer Unicon has brought a new era into the industry. With more than 20 years of unique practical experience and know-how in dry condensing, Kramer again offers new avenues of opportunity to the air conditioning and refrigeration industry.

Unicon now has no capacity limit. Standard Unicon systems up to 540 tons are now cataloged for the first time.

Unicons for heat pump applications are now also available with no horsepower limitations.

Kramer engineering and design has proven that the Unicon can move large volumes of air with extreme quietness.

Unicon has long proven by actual experience that it is free from fouling or corrosion and requires practically no maintenance.

The total operating weight per ton for Unicon is very low, resulting in minimum platform and reinforcement requirements.

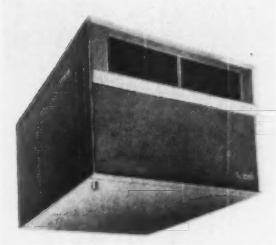
Unicon space requirements are surprisingly small; a 300 ton system requires only 15′ x 14′ floor space and is 12′ high.

WRITE FOR BULLETIN U-391

## KRAMER TRENTON CO. • Trenton 5, N.J.

*44 YEARS OF CONTINUOUS ACHIEVEMENT IN HEAT TRANSFER*

ny. Plug is faced with a resilient material. Other features cited: straight through flow design; position of valve determined by position of quarter turn handle. Recommended by manufacturer for applications such as balancing valve for chilled water shutoff, condensor water shutoff, others.



## Air Conditioners . . .

. . . designed for space saving ceiling installation in retail stores, factories, offices, other commercial establishments—*Typhoon Air Conditioning Co., Div. of Hupp Corp., Dept. HPAC, 505 Carroll St., Brooklyn 15, New York.*

Ceiling mounted air conditioners available in 5, 8 ton models. Cabinets measure 57 in. long by 44 in. wide by 32 in. deep. The 5 ton model weighs 845 lb; 8 ton model, 970 lb. The 5 ton model provides cooling capacity of 60,600 Btu per hr; 8 ton model, 97,500 Btu per hr. Both equipped with oversize hermetically sealed compressors. Units available with plenum grille. Available with optional line voltage or low voltage control systems. Both systems use remote thermostat and selector switch. Low voltage system includes panel with transformer, relays. High-low pressure switches safeguard equipment against abnormal operation. Condensers are of all copper construction; cabinets use 14 gage rolled steel.

## Slurry Pumps . . .

. . . designed for accurate proportioning applications—*Milton Roy Co., Dept. HPAC, 1300 E. Mermaid Lane, Philadelphia 18.*

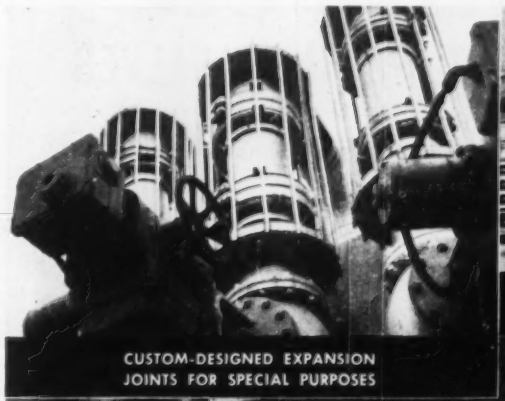
"Oliver Diaphragm Slurry (ODS)"



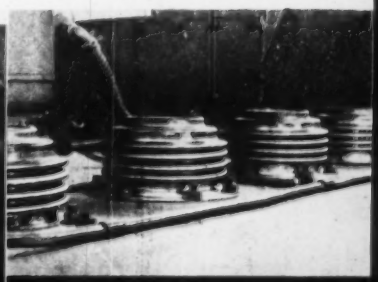
The answer to your pipe expansion problems

**Flexon**®

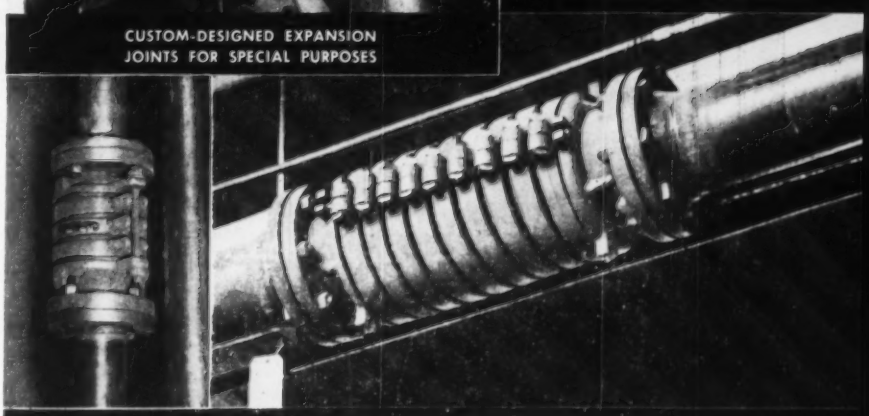
Expansion Joints



CUSTOM-DESIGNED EXPANSION JOINTS FOR SPECIAL PURPOSES



FREE-FLEXING PACKLESS EXPANSION JOINTS



CONTROLLED-FLEXING PACKLESS EXPANSION JOINTS

Here's where you'll find the skill and experience to guide your selection of ways to take care of pipe motion problems. Flexon engineering gives you more – more research, more metallurgical care, more service, more "standards" to select from. And all of these add up to expansion joints that you can *install and forget!* Free-flexing and controlled-flexing; pressure-balanced joints and other special designs; all in stainless steel, monel, and other workable alloys.

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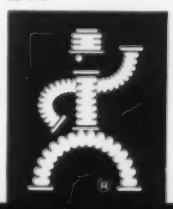
Why settle for *less* – when experience shows that you get *more* of everything from Flexon?

**TODAY — write for your copy of this 28-page Flexon Expansion Joint Design Guide**

EJ-818



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corporation

EXPANSION JOINT DIVISION • 1341 S. THIRD AVENUE, MAYWOOD, ILLINOIS

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Corrosion got you on the hook?

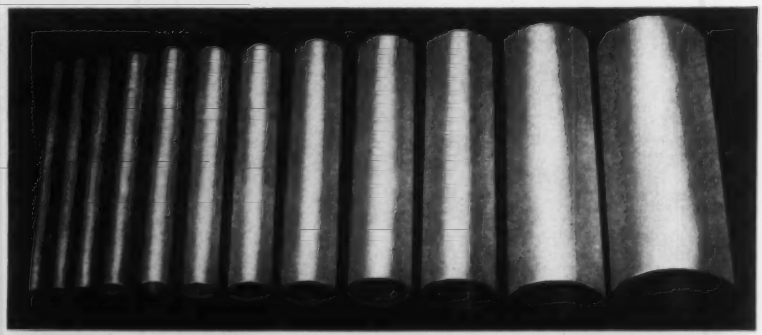
INVESTIGATE

Van-Cor

PIPE, FITTINGS, VALVES

made of Rigid, Unplasticized

POLYVINYL CHLORIDE



**ADVANTAGES:**

Resists Corrosion of Hundreds of Industrial Acids & Alkalies
Light in Weight (½ that of Aluminum)
Easily Installed; High Tensile Strength; Low Flow Resistance
Readily Formed, Machined, Threaded and Welded

**TWO TYPES:**

1. Chemical Resistant, NORMAL Impact (Van-Cor 1)
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**AVAILABLE FORMS:**

Pipe: ¼″ thru 12″ diam. (10 or 20 ft. lengths)
Fittings: ¼″ thru 12″
Valves: ½″ thru 3″
Sheets: 1/16″ thru 2″ (48″ x 96″)
Bar Stock: ¼″ thru 2″ (10 ft. lengths)
Custom Fabrications
Custom Extrusions

*Request Complete Catalog containing detailed specifications, diagrams, flow charts, chemical resistance tables and installation data.*

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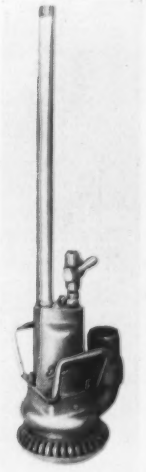
COLONIAL PLASTICS MFG. CO.
Subsidiary of THE VAN DORN IRON WORKS CO.
2685 EAST 79TH STREET CLEVELAND 4, OHIO


## EQUIPMENT DEVELOPMENTS

*Continued*

pump, manufactured under license, intended for applications handling flows such as abrasive slurries, viscous solutions, easily damaged floc or crystals.



### Sump Pump . . .

. . . designed for low head pumping operations of contractors, utilities, industrial plants—*Thor Power Tool Co., Dept. HPAC, Prudential Plaza, Chicago* 1.

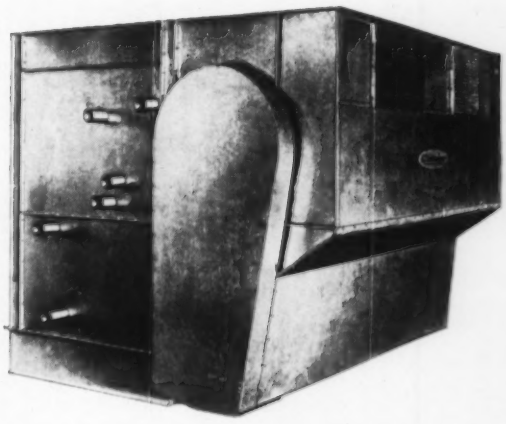
Company's new air sump pump weighs 35¾ lb, drains 200 gpm. Unit is powered by a four blade, rotary air motor that runs with less than 50 cu ft of compressed air under full load. Pump is available in nonsparking bronze models for pumping corrosive, inflammable or other liquids.

### Air Conditioner Timer . . .

. . . designed for use with window air conditioners, works on 24 hr schedule—*Paragon Electric Co., Dept. HPAC, Two Rivers, Wis.*

"AC1-0 Ti-mite" is completely automatic in operation, does not operate during off occupancy periods. Unit can be set to precool room, turn off air conditioner. Provided with 5 ft, three wire air conditioner cord with three wire grounded plug. Electrical rating: 120 volts, 60 cycle; 12 amp, full load, 1 hp. Not available at 240 volts.

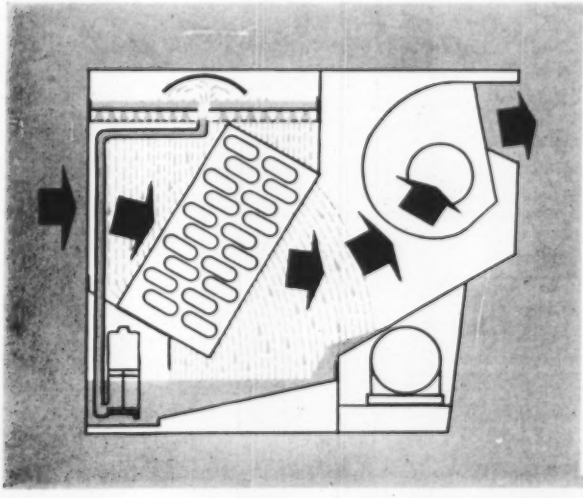
# a completely new evaporative condenser design– by Carrier!



**Exclusive new water distribution method requires no spray nozzles or eliminators. New light-weight, low-silhouette units ideal for roof-top installations. Easy access for servicing parts.**

From Carrier, originator of the evaporative condenser, comes another major advance—an evaporative condenser completely new in design. This new unit sets new standards of efficiency in heat disposal where water supply and drainage are problems. Capacities range from 5 to 250 tons for all refrigerants. The principles and advantages of the new design are explained briefly below. For complete information, look up the Carrier dealer or branch office listed in the Classified Directory. Or write Carrier Corporation, Syracuse, New York.

**AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING** Carrier



### New design features of Carrier Evaporative Condensers

Using a unique, Carrier-developed water distributing process, the new Evaporative Condensers operate without spray nozzles or eliminators. Here's how: Powerful centrifugal fans draw liberal quantities of air into the unit and over the water-drenched condensing coil. The evaporative cooling effect of the air on the water passing over the coil condenses the refrigerant vapor in the coil tubes. The liquefied refrigerant then passes from the coil and returns to the cooling system, where it is used in evaporators for air conditioning or process refrigeration.

Coil wetting is accomplished by a simple but highly effective water distributing pan arrangement above the condensing coil. Water, pumped to the top of the pan, is diffused evenly over the entire coil surface through regularly spaced orifice openings in the pan. As the metered water passes through the lower interceptor screen, it is broken into small, rainlike droplets which completely drench the coil surface. Completing the cycle, the water flows by gravity into the base pan, where it is strained before being pumped again to the water distributing pan above.

RUST-PROOFED HOT WATER GENERATORS

Now stop corrosion, eliminate rusty water or contaminated contents before it starts by specifying Novelon lined hot water generators and storage tanks by Ellicott.
Ellicott has combined its fifty years of building unfired pressure vessels and storage tanks—with ten years of developing a complete line of Novelon Linings of cement, rubber, lead, copper and the new plastic linings that allow much higher heat resistence. Novelon linings solve the corrosion problems in storing and processing water, acid, food and chemicals. Send us your corrosion problem today.

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HOT WATER GENERATORS | STORAGE TANKS | SPECIAL LININGS | SPECIAL FABRICATION

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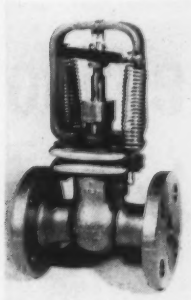
## EQUIPMENT DEVELOPMENTS

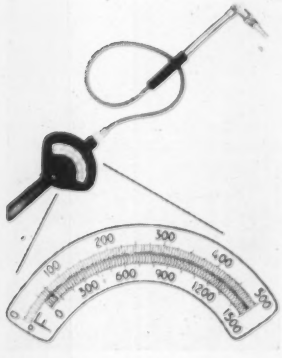
*Continued*



### Gate Valve . . .

. . .developed as safeguard against fire feeding, designed to shut off fluid flow as temperatures build up—*Cooper Alloy Corp., Dept. HPAC, Bloy St. and Ramsey Ave., Hillside 5, N. J.*

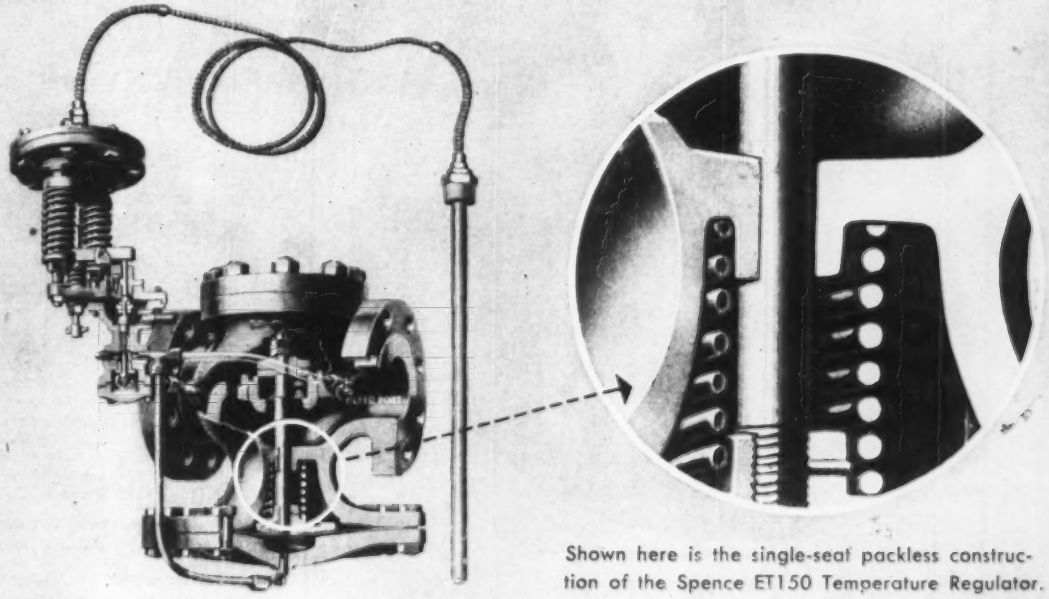
Spring loaded valve closes when temperature around it reaches link melting point of 160 F, separating link, which releases springs, shuts off supply of combustibles through valve into fire area. Valve also has rotating double disc assembly to maintain tight seal even when body distorts due to heat. Springs made of stainless steel to resist atmospheric corrosion during normal plant operation. Valve available in alloy types 304, 316, as well as monel, nickel in sizes ½ to 2 in. Retained bonnet gasket, one piece stem, disc carrier also incorporated. Operating pressures to 150 psi.




### Surface Pyrometer . . .

. . .designed for plant and laboratory surface and sub-surface temperature measurements—*Pyrometer Instrument Co., Inc., Dept. HPAC, Bergenfield, N. J.*

# *Advantages of Packless Construction in Temperature Regulating Valves*



Shown here is the single-seat packless construction of the Spence ET150 Temperature Regulator.

One of the biggest headaches in regulating valve maintenance is repacking stuffing boxes.

How often a valve needs repacking, how much time it takes, and the cost of the system downtime all vary with the construction of the regulator and the service it's used for. No matter how you calculate all these variables it's still a headache—and an expensive one.

In the temperature regulator shown above (Spence Type ET150) stuffing boxes are eliminated. This is done by what is known as "balanced" diaphragm construction. You can see in the cutaway drawing that pressure is applied to both sides of the large metal diaphragm. The upper side is exposed to delivery steam pressure and the lower side is exposed to loading pressure applied by the pilot. When the pilot closes, both delivery pressure and loading pressure are equalized through the bleedport and connecting tubing.

This construction not only does away with repacking problems, but it makes possible additional savings as well. For example, you will note in the sectional blow-up that this design eliminates a closely fitted stem and guide. Dirt or other foreign matter doesn't have much of a chance to lodge between these parts and cause sticking.

Another cause of binding or sticking, uneven expansion of closely fitted parts, is also eliminated with this design. In addition, valve stem wear is reduced for the same reason.

Lower maintenance is not the only advantage of this packless construction. Accuracy of regulation is also improved because friction due to a stuffing box, dirt, or uneven expansion is not a problem. The large, *balanced* metal diaphragm is more sensitive to slight changes in pressure.

## Guaranteed Not To Wiredraw

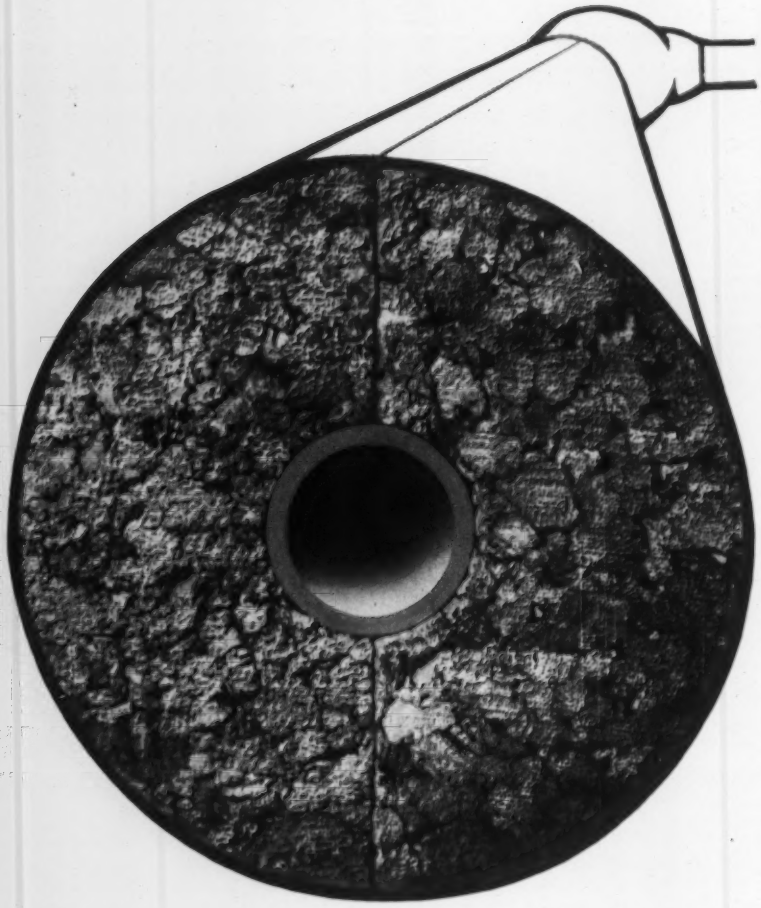
If seats and discs are cut by steam (wiredrawn) the loss of steam through these grooves can be another expensive item — directly charged against the regulating valve. Fortunately, you can eliminate these costly leaks by specifying a temperature regulator that is *guaranteed not to wiredraw*.

Spence makes such a guarantee because their seats and discs are made of SECO Metal. Over 20 years experience with this special alloy has failed to produce a single case where a SECO Metal seat or disc had been cut by steam. All that's required is an approved strainer located ahead of the regulating valve. Expensive steam leaks just can't happen with this combination of SECO Metal and single-seat design.

If you would like to have more information on Spence Temperature Regulators, drop us a line and ask for Bulletin T150. It gives more detailed information on these and other Spence design features. Piping layouts and helpful information on the installation of temperature regulators are also included. Write for your copy today.

SPENCE ENGINEERING COMPANY, INC.
*Walden, New York*

SE 140



# United's Molded Cork Pipe Covering

FITS TIGHTER . . . GOES ON FASTER . . . PROVIDES MAXIMUM PROTECTION — When it comes to advantages, no other product can match *all* the benefits of United Cork's Molded Pipe Covering. Made from pure, clean, granulated cork, compressed and molded to exact size and shape and finished with a coating of plastic asphalt, it is an ideal covering for brine, ammonia, ice water, and cold lines of every kind. It has an extremely stable K factor over a wide low temperature range, will not rot or support combustion and is clean, sanitary and odor free. It is easy to install . . . and in the long run it's the least expensive.

*Available in a wide variety of sizes and shapes from local stocks in key areas, coast to coast. Write today for more complete information as well as helpful installation data.*

UNITED BB CORKBOARD

**UNITED CORK COMPANIES**

Since 1907

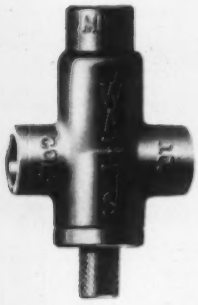
1 Central Avenue, Kearny, N. J.

*Engineering offices or approved distributors in key cities — coast to coast.*

## EQUIPMENT DEVELOPMENTS

*Continued*

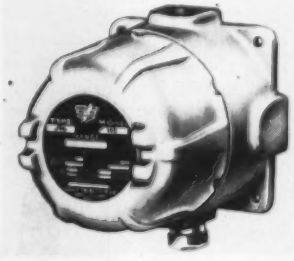
"Model DR35" indicator has two scale ranges in different colors; low range from zero to 500 F is subdivided into 5 deg divisions; high range reads from zero to 1500 F. Range selector switch permits change from one scale to the other. Meter corrects itself for changes in room temperature on both scales, accurate to 1½ percent. Steel housing is dust, moisture and shock resistant. Available with selection of 15 types of interchangeable thermocouples.



### Tempering Valve . . .

. . . with special thermostat feature—*Watts Regulator Co., Dept. HPAC, 10 Embankment Rd., Lawrence, Mass.*

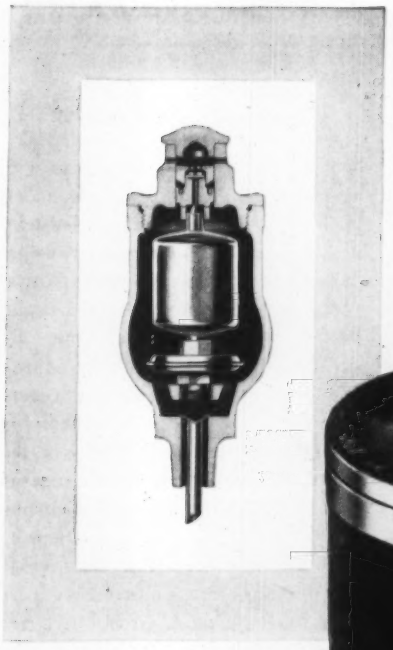
Thermostat on tempering valve completely shuts off cold water supply with excessive demand for hot water, assuring full rated capacity delivery, according to manufacturer. Said to be corrosion resistant because lime or scale accumulation is penetrated by thermostatic force. Available in ½ in. size with sweat copper fittings.



### Pressure Control . . .

. . . in explosionproof, dual switch design—*United Electric Controls, Dept. HPAC, 79 School St., Watertown,*

# A well placed air vent can work a heating miracle!



In a Wilmette Illinois Building, an outwardly well-engineered vacuum system had been a headache for years. Then, last winter, along came a heating man who quickly sized up the situation and said with real conviction: "Put a Marsh No. 5 Vent right there!"

That did it! One inexpensive vent cleaned up a spotty, erratic condition, that a number of expensive alterations had failed to touch.

Unusual? Not in the least: over the years we have seen a lot of wonders worked by installing the right kind of Marsh air vent in the right spot. A number of these dependable vents are illustrated here . . . products that express an unrivaled accumulation of knowledge in dealing with air venting problems.

Marsh air vents are fully covered by the Marsh Heating Specialty Catalog along with Marsh Traps and Valves. Your local Marsh man will be glad to work with you in applying Marsh Vents effectively.

**MARSH HEATING EQUIPMENT CO.**

*Sales Affiliate of Jas. P. Marsh Corporation*

**Dept. T, Skokie, Ill.**

Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd Street, Edmonton, Alberta, Canada

**No. 5 Rapid Vent.** Float and thermostatic construction. Designed for use at the end of steam mains, tops of risers and other similar locations on vapor and one pipe vacuum systems where the maximum venting requirement does not exceed one cubic foot per minute at 5 psi.

**No. 6 Quick Vent.** Thermostatic only. Designed for installation at high points in the piping where there is not sufficient room for the No. 5 Vent or where a float is not needed. Same venting capacity as No. 5.

**No. 50 Air Vent.** Float only. Designed to remove air and gases automatically from hot or cold water tanks, coils or piping, liquid pump systems or similar applications where it is necessary to vent air rapidly. Maximum working pressure, 125 psi.

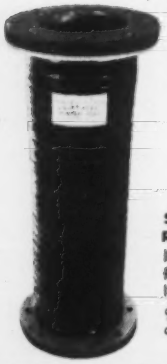
**No. 55 Air Vent.** Float and thermostatic construction. Is capable of expelling large volumes of air without passage of water or steam and is designed for use on steam pressure vessels or systems. Maximum working pressure, 125 psi.

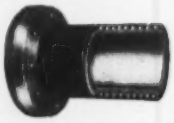
**No. 7 Air Eliminator.** Float and thermostatic construction. Expecially suitable for installation at the ends of steam mains, return piping and tops of risers where it is necessary to expel a large volume of air from the system. Suitable for working pressures up to 15 psi.

# MARSH

*Quality Heating Specialties since 1865*

a quiet answer to noisy piping...





Style RFE— Integral molded rubber flanges keep entire hose length flexible . . . eliminate gaskets. Steel backup rings distribute bolt pressure.

# VMC QUIET-FLEX

## REINFORCED FLEXIBLE RUBBER PIPE SECTIONS

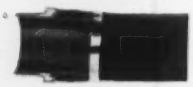
Completely isolate pipe lines from pumps, centrifugal compressors, condensing units, water chillers and cooling towers. Quiet-Flex rubber pipe connections will withstand working pressures up to 250 psi . . . continuous operating temperatures up to 250°F.

**Write for descriptive Bulletin RFP-10 and Vibration Engineering Data Book.**

If it's a noise or vibration problem, get the right answer — quick — from

Representatives in Principal Cities of United States and Canada

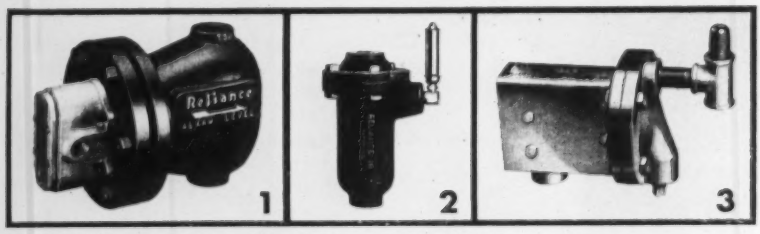
Style MM— Brass fitted couplings with male pipe threads provide leak-proof connection with uniform full flow area. Stock sizes—¾" through 4" diameter in lengths 12" through 36".



**VIBRATION MOUNTINGS, INC.**

98-11 50th Avenue • Corona 68, New York






## *3 easy, inexpensive ways*

### to protect your small boilers and tanks . . .

### Reliance Liquid Level Alarms

Is somebody *always* watching your liquid level gages? If not, you need extra signals to give warning when levels get too low or too high for safety. Reliance Safety Devices help you avoid water level accidents.

1. Levalarm EA-6: Sturdy, sensitive switch device for 0 to 250 lbs., can be used indoors or out.
2. Reliance Junior Alarm: Quick-acting float-operated whistle alarm for small boilers — up to 250 lbs.
3. Levalarm EA-7: Attaches to water column whistle valve — actuates electric signals anywhere.

Reliance 2-light and 3-light indicators and vibratory horn, controlled by above devices, can be placed anywhere to catch attention of operators. *Write for Bulletin D1 describing these Alarm Devices.*

**The Reliance Gauge Column Co.**

5902 Carnegie Ave. • Cleveland 3, Ohio

**Reliance Boiler Safety Devices since 1884**


## EQUIPMENT DEVELOPMENTS

*Continued*

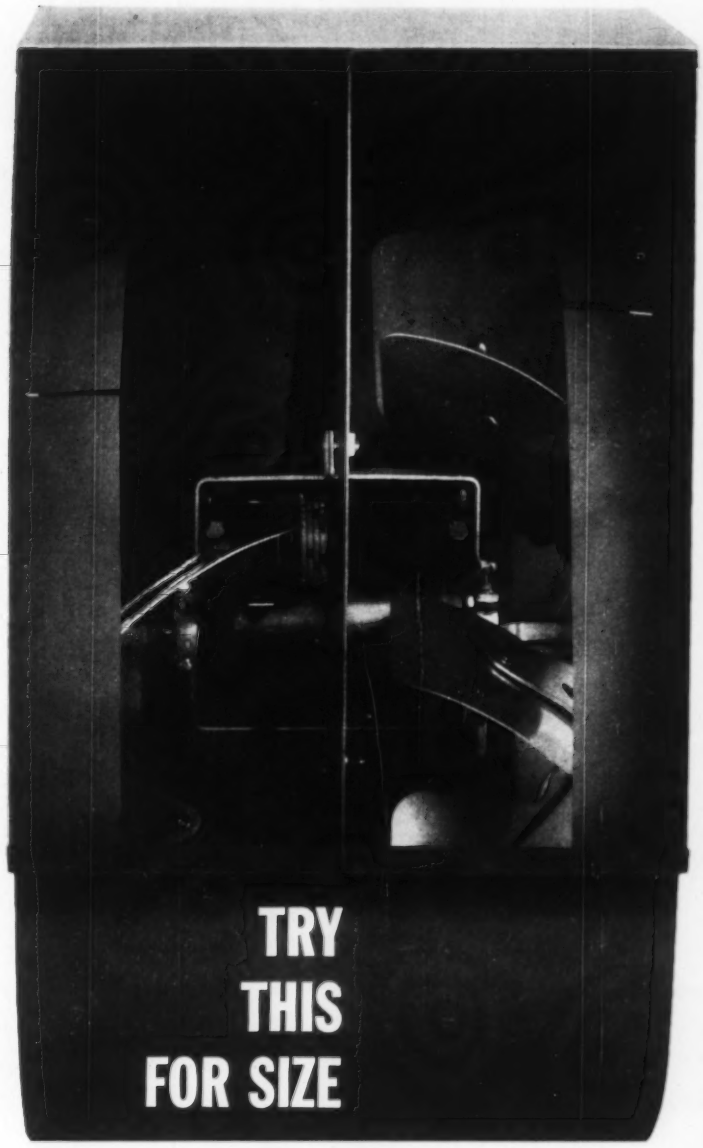
*Mass.*

"J96A" Control has two completely separate switches, permitting independent switch action above or below set point, control of two independent circuits, flexibility of switching arrangement. Designed for use in hazardous locations where explosive vapors or gases are present. Uncalibrated pressure settings made individually on each switch by adjustment screws after removing cover. Switches may be set together to simulate double pole circuitry or set apart to obtain independent operation. Differentials between switches vary with model or requirement. "J96A" has cast iron base, cast aluminum cover. Construction permits use in Class I, Groups C & D; Class II, Groups E, F & G; Class III as defined by National Electrical Code. Approximate weight 3 lb, 6 oz. Switches rated for 15 amp at 115 or 230 volts. Suitable for 180 F.

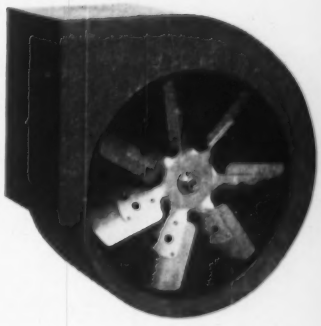
### Union Bonnet Valves . . .

. . . for general use in industry on air, oil, water, gas, steam service—*Ohio Brass Co., Dept. HPAC, 380 N. Main St., Mansfield, Ohio.*

Union bonnet, composition disc globe and angle are rated for 150 lb working steam pressure or 300 lb for water, oil or gas. "No. 700" valves especially suited for process, maintenance lines where operation is frequent and tight shutoff is necessary, according to company. Normally furnished with hard composition, renewable steam discs; soft discs for water, gas, oil, air furnished upon request. Available in sizes ⅛ through 3 in.



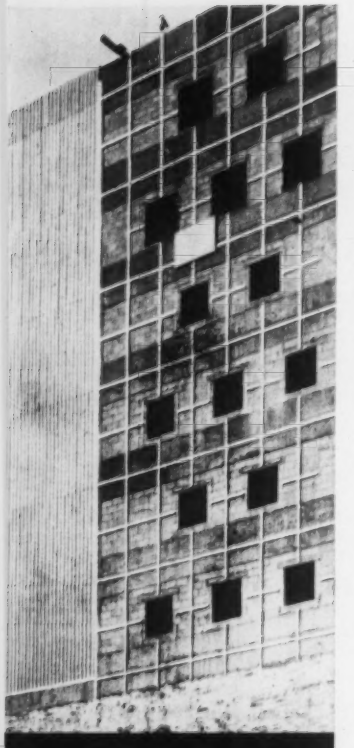

IT'S THE GREAT NEW TORRINGTON MIXED-FLOW RADIAX ▮ 6 SIZES FROM 300 TO 3000 CFM ▮ SAVINGS UP TO $10 PER UNIT ▮ SIZE, WEIGHT AND MOTOR ECONOMY ▮ PLUS TORRINGTON REPUTATION ▮ FULL DETAILS AND ENGINEERING SERVICE ON REQUEST



## IN YOUR '59 DESIGNS

**THE TORRINGTON MANUFACTURING COMPANY**

TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO



# HIT THE DOUBLE JACKPOT!

***Save 40% in time, labor, materials with Ramset and Shure-Set!***

That's what a Baltimore contractor saved . . . 40%. That's the kind of saving you can expect when you use—

*RAMSET for heavy-duty fastening to steel and solid concrete . . . SHURE-SET for light fastening to masonry and concrete block!*

You get the lowest in-place cost without drilling, bolting or plugging. No power lines, no bulky equipment. You increase your profit two ways on *every* job!

## *Ramset*®

Powder-actuated RAMSET is up to 15 times faster than old-style fastening methods. Completely portable. Every RAMSET fastener is 100% guaranteed, and it's Austempered for high hardness combined with maximum toughness.

## *Shure-Set*®

SHURE-SET drives like a nail, holds like an anchor . . . uses every ounce of power behind every hammer blow. Uses no cartridge. Sets pins faster, more securely—without bending or breaking . . . right through light-gauge metal.

Ask your RAMSET dealer to supply both tools. Look under "Tools" in the yellow pages, or write for free booklet *today!*

**Ramset Fastening System**

WINCHESTER-WESTERN DIVISION

OLIN MATHIESON CHEMICAL CORPORATION

12109-G Berea Road • Cleveland 11, Ohio

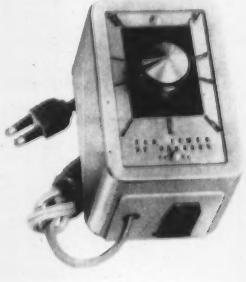

## EQUIPMENT DEVELOPMENTS

*Continued*

### Bleeder Valve . . .

. . . made of corrosion resistant polyvinyl chloride—*Walworth Co., Dept. HPAC, 750 Third Ave., New York 17.*

Bleeder valve can be used for bleeding, sampling, drawing off small amounts of liquid from pipe lines, duct systems, tanks, similar applications. Has no packing, operates as does drain cock on auto radiator or steam boiler. Seal formed by back seat at base of valve stem insures tight closure, says company. Left hand threading causes valve to close when hand wheel is rotated in clockwise direction. Available in $\frac{3}{4}$ in. size with male IPS threads; can be screwed into female threaded $\frac{3}{4}$ in. fitting or fixture or used with bushings for size adustment.

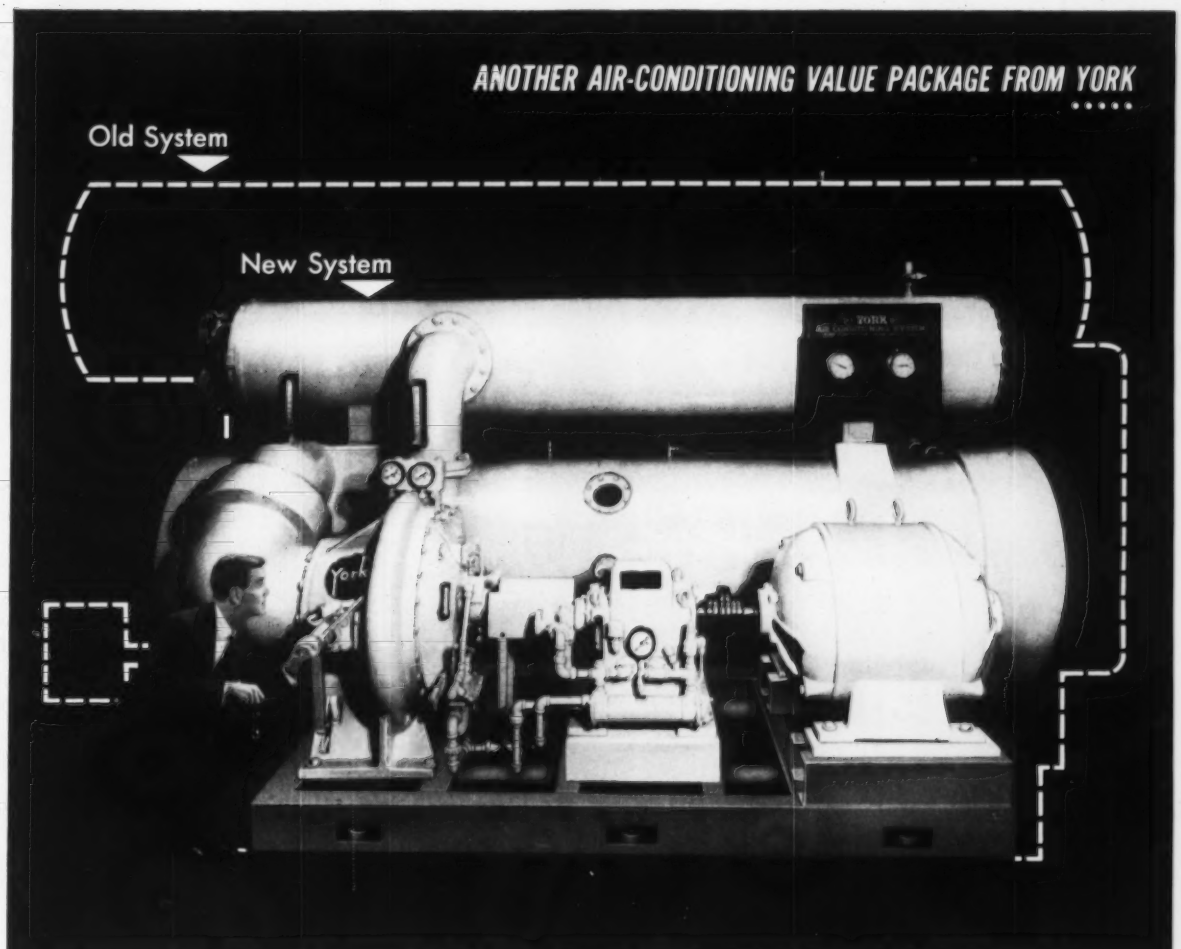


### Fan Timer . . .

. . . designed to automatically shut off fan for any pre-selected time up to 24 hrs—*Paragon Electric Co., Dept. HPAC, Two Rivers, Wis.*

"Model PF31-0" powered by quiet, self-starting, industrial type motor, can be used with any fan to $\frac{1}{4}$ hp, 120 volts, 60 cycle, a-c. Case is gray and black, with silver setting knob, black and silver dial.

ANOTHER AIR-CONDITIONING VALUE PACKAGE FROM YORK




# TURBO WATER COOLING SYSTEM

- **Number of parts and deadweight cut as much as 400% over previous models!**
- **Widest range of capacities: 100 to 600 tons . . . with single-stage simplicity!**
- **Completely automatic adjustment for all load conditions insures long-run economies!**
- **Quiet, vibration-free operation!**
- **Any prime mover can be used!**

These are features that consulting engineers and contractors have long sought, and now make York's single-stage Turbo Systems an *engineered value* unmatched in the air-conditioning industry:

**EASIER INSTALLATION!** These compact, lightweight systems require no special foundations; occupy a minimum of space. The advanced single-stage compressor out-performs multi-stage systems twice its size . . . and does away with such equipment as flash coolers, extra float valves, extra piping and its insulation.

**MORE ECONOMICAL PERFORMANCE!** Stable operation under all load conditions is assured. York Turbos can be run completely by automatic capacity control . . . without supervision. Complicated control devices have been eliminated. There are no oil pumps to start.

**SIMPLIFIED MAINTENANCE!** The York Turbo is more nearly hermetically-sealed than any other centrifugal system. Contamination of the refrigerant is positively prevented. The use of a lightweight aluminum rotor (the only moving part)—and a small, flexible shaft coupling reduces wear. All running parts are removable as a package for inspection . . . are readily accessible without disturbing refrigerant connections!

These important features are the direct result of York's tradition of designing with the *real cost* of air-conditioning in mind. They are just a few of the many you and your clients may want explained in detail. Check your classified directory for your local York factory representative . . . or write York Corporation, York, Pennsylvania.

YORK CORPORATION

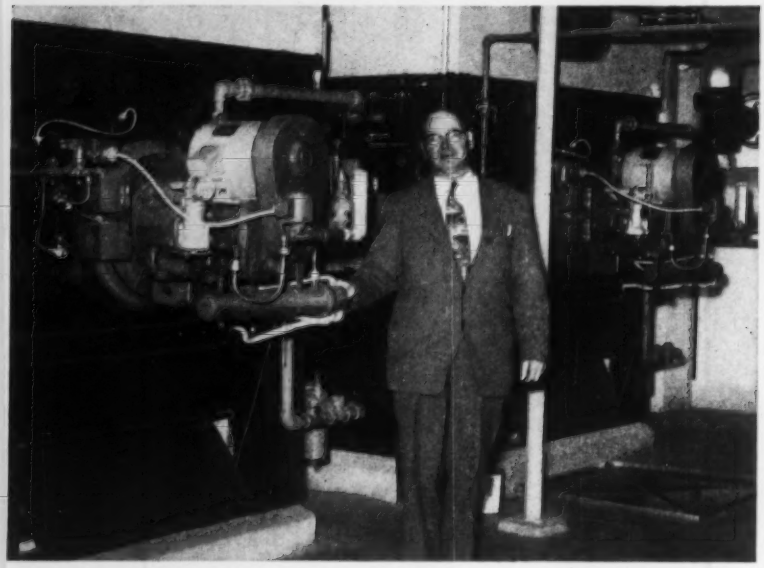
*Millions Live Better with York*

SUBSIDIARY OF BORG-WARNER CORPORATION

IN CANADA: CANADIAN ICE MACHINE COMPANY LTD., TORONTO

*"I've handled the ENTERPRISE line for 12 years. They're still the best burner buy!"*

Says Al Wilcox, Enterprise Burner Distributor, Seattle, Wash.



Mr. Wilcox and the two Size K-3 Enterprise Oil Burners installed at Asa Mercer Jr. High School, Seattle.

**Engineers, Contractors, Users—all agree:**

*"Everyone Benefits When It's an Enterprise!"*

"As a long-time Enterprise dealer," Mr. Wilcox writes, "I know the advantages to all concerned of installing the best oil burner made—an Enterprise.

"Engineers and contractors benefit because Enterprise delivers high performance so uniform that burners are frequently specified as 'Enterprise or equal.'

"Users benefit from operating efficiency and economy beyond their expectations—year after year and with minimum servicing needs.

"And by supplying the top quality burner all groups want, the dealer benefits—through satisfied customers, little servicing, and excellent relations with the Enterprise factory people."

You're bound to agree with Mr. Wilcox, too. Just check the complete range of Enterprise Burner sizes shown here. If your specifications fit, your best buy is an Enterprise. Get all the facts, today!

**HORIZONTAL ROTARY OIL BURNERS, & COMBINATION OIL & GAS BURNERS**

| | INPUT | | | OUTPUT | | |
|---|---|---|---|---|---|---|
| Burner Size | Motor HP | Oil-GPH Max | Gas CF/HR | Steam LBS/HR | Steam BHP | Radiation-Sq. Ft. Steam |
| AA | ½ | 4 | 600 | 464 | 13 | 1880 |
| A | ½ | 7 | 1050 | 812 | 23 | 3280 |
| C | ½ | 15 | 2250 | 1740 | 50 | 7050 |
| E | ½ | 20 | 3000 | 2320 | 67 | 9400 |
| F | ¾ | 30 | 4500 | 3480 | 100 | 14100 |
| G | 1 | 35 | 5250 | 4060 | 118 | 16400 |
| H | 1 | 50 | 7500 | 5800 | 168 | 23400 |
| H | 1½ | 60 | 9000 | 6960 | 201 | 28200 |
| J | 2 | 75 | 11250 | 8700 | 250 | 35250 |
| K | 3 | 100 | 15000 | 11600 | 336 | 46900 |
| L | 3 | 135 | 20250 | 15660 | 453 | 63400 |
| M | 5 | 200 | 30000 | 23200 | 672 | 94000 |

*The Choice of Heating Experts*

**ENTERPRISE**

**DEPENDABLE BURNERS**

ENTERPRISE ENGINE & MACHINERY CO. • 18TH AND FLORIDA STS., SAN FRANCISCO, CALIFORNIA

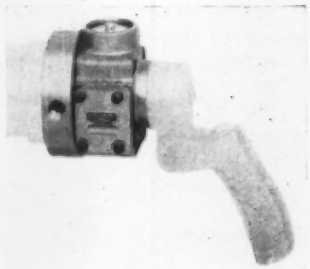
## EQUIPMENT DEVELOPMENTS

*Continued*

### Temperature Control . . .

. . . designed specifically for use in tobacco curing barns to control stokers, oil burners, other heating sources—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown 72, Mass.*

"Model 4385A" tobacco curing temperature control is weatherproof, bugproof, says manufacturer, has die-cast aluminum, black wrinkle finish enclosure and is provided with 1/16 in. galvanized steel mounting. Since thermal element with 9 ft capillary is completely inside building, control said to be unaffected by outside temperatures. Temperature settings made outside building by rotating single turn knob against calibrated dial. Standard models provide range of 85 to 185 F, with on-off switch differential of 2 F or less. Ratings are 15 amp 115/230 volts a-c; motor ratings, 1/6 hp. at 115 volt a-c, 1/3 hp at 230 volts a-c.



### Air Control Valve . . .

. . . designed for integral mounting on popular make portable gun welders—*Valvair Corp., Dept. HPAC, 454 Morgan Ave., Akron 11.*

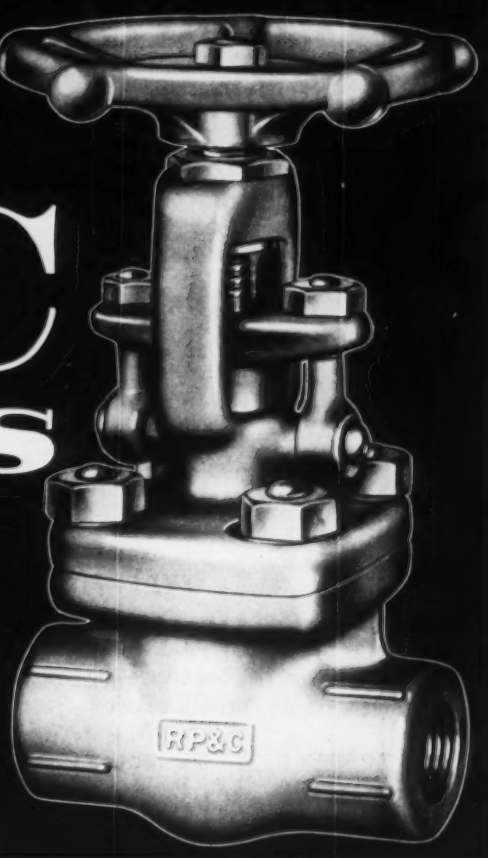
Valve is mounted directly on welding gun cylinder. Kit consists of aluminum manifold adapter plate

**ACCO**
for Better Values

THE COMPLETE LINE—

# R-P&C VALVES

DESIGNED FOR DEPENDABILITY




## This new FORGED STEEL GLOBE VALVE offers maximum strength and safety...longer life!

• R-P&C's new F80 Forged Steel Globe Valve is a versatile, precision-built addition to a distinguished valve family. Designed and engineered in cooperation with many of the country's leading engineers of the power, process piping and shipbuilding industries, the F80 Globe Valve is manufactured to the most rigid standards to overcome the problems of ever-increasing temperatures, pressures and corrosion.

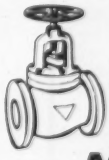
Here are a few of its many features that insure greater strength and safety, longer service life and lower maintenance cost: Forged Steel body, bonnet and gland..."375 Brinell" stem with rolled stem threads..."500 Brinell" disc-lapped seat face...molded, reinforced asbestos packing. Test Pressures: Hydrostatic Shell test, 2500 P.S.I....Seat Test (air under water), 100 P.S.I....Pneumatic Testing at 300 P.S.I. when specified. For details, *write for Folder DH-213.*

### R-P&C offers a Complete Line

• Look to your R-P&C Distributor for R-P&C gate, globe, angle and check valves—in bronze, electric iron, cast or forged steel—in a wide range of styles, sizes and pressure classes. In addition, R-P&C offers a full line of cast steel fittings, also specialties such as asbestos-packed cocks, bar stock valves, Lubrotite gate valves and other items. For complete R-P&C catalog, write our Reading office.

BAR STOCK VALVE

BRONZE GATE VALVE


IRON GLOBE VALVE

**FREE WALL CHART**
***"How to Protect Your Valves"***
Installation pointers, operating tips, clues to longer valve life. They are all on this 22" x 17" wall chart. Write for your free copy.

**R-P & C VALVE DIVISION**
**AMERICAN CHAIN & CABLE**

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

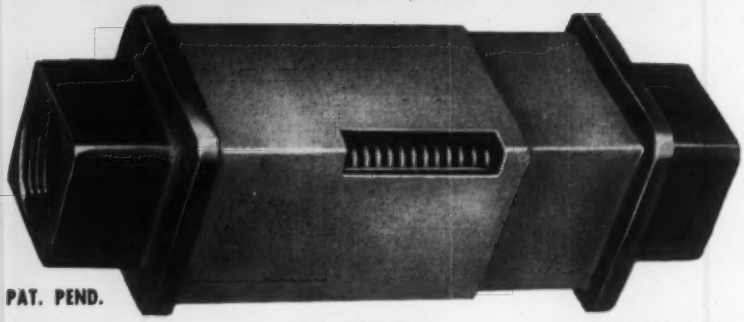
ACCO

# Keflex QUADRA-SIDE

## Telescopic Expansion Compensators

WITH LAMINATED STAINLESS STEEL BELLOWS, 2 PLY OR MORE

*. . . something new for the* ARCHITECT – ENGINEER – CONTRACTOR

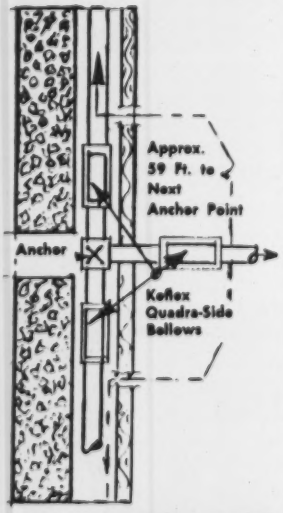


PAT. PEND.

**TYPE 7Q** SIZES ¾"-3" Inc.

Working Pressure 300 P.S.I. — Temperature to 800°F. — Has Reserve Strength — Not Just Borderline Prospect of Withstanding Effect of Pressure — Shock — Thermal Line Expansion — High Temperature — Moderate Vibration.
HIDDEN PROTECTION PLUS! All Non Corrosive Stainless Steel Bellows With Brass or Bronze End Fittings and Telescopic Shrouds.

KEFLEX FITS IN NARROWEST WALL SPACE—SAFE—PERMANENT




● **ROUND** KEFLEX Bellows are made of Laminated Stainless Steel, multiple ply (usually 2 ply or more) for greater strength with minimum force required to move bellows. The minimum force to move 7 Q Keflex Bellows greatly reduces the need for additional anchoring above that required to handle line pressure thrust force as the force to move Keflex 7 Q only is always less than 100 lbs.

● **FLAT** KEFLEX FLAT GUIDES offer so many advantages it is difficult to mention them all. Briefly: The KEFLEX FLAT OUTSIDE GUIDE (shroud) is made of brass USUALLY formed square of required length —one unit end will telescope over other unit end. The flat surfaces slide over and in one another—practically eliminating possibility of torque as result of faulty installation. This ASSISTS PROPER GUIDING.

● **SQUARE** KEFLEX SQUARE END FITTINGS are made of heavy, non-porous, square, bronze stock, and threaded tapered female pipe size. They are attached to the KEFLEX 7 Q bellows and the outside guides by silver brazing. The result is an easy moving expansion joint that will absorb either the slightest or the greatest thermal pipe expansion and with practically no load on the anchors. The heavy bronze ends, which will not crush during normal installations, assures safe and leakproof joints.

KEFLEX®

▶▶▶ WRITE TODAY FOR LITERATURE

**U. S. FLEXIBLE METALLIC TUBING CO.**

SINCE 1903

KEFLEX MANUFACTURING DIVISION

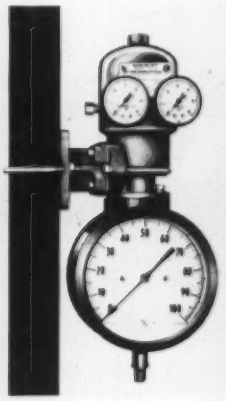
454 EAST THIRD STREET, LOS ANGELES 13, CALIFORNIA

SAN FRANCISCO 5 63 MAIN ST. | PORTLAND 9, OREGON 328 N.W. BROADWAY | SEATTLE 4, WASHINGTON 2425—6TH AVE. S.


## EQUIPMENT DEVELOPMENTS

*Continued*

installed on gun cylinder, replacing existing cylinder head and handle adapter. Pilot-operated valve bolts to manifold adapter plate. Adapter boss on valve body provided for attaching gun welder handle. Valve of all aluminum construction with solenoid coil available for a-c or d-c and any voltage. Valve stem is hard-coated aluminum with o-ring packers. Manual over-ride also offered.



### Pneumatic Transmitters . . .

. . . in indicating and non-indicating types—*Manning, Maxwell & Moore, Inc., Dept. HPAC, 250 E. Main St., Stratford, Conn.*

"Series 1250" solid front pneumatic pressure transmitter incorporates sensing and indicating element for measuring pressures to 100,000 psi with an accuracy of 0.5 percent. Transmitter output is 3 to 15 or 3 to 27 psi signal proportional to input pressure. Plastic coated rear disc provides access to gage and transmitter, also serves as safety blowout relief. "Series 1260" non-indicating pressure transmitter feeds to indicating gages, recording receivers, controllers. Available in ranges zero to 100 in. water, zero to 20,000 psi with an accuracy of 0.5 percent, sensitivity of 0.1 percent. "Series 1253" has bellows actuating element, permitting measurement of low pressures zero to 20 in. water. "Series 3800-3900" measures temperature in installations where thermostatic element is more applicable than thermocouple actuation.

"You mean the air diffusers have been installed before you know how this floor will be divided?"

"Sure. We're using MULTIVENT. We can put partitions anywhere we want . . . now, or in the future . . ."

You're free to locate partitioned office space wherever it's needed, when you work with Multi-Vent low velocity air diffusers.

Once installed flush in the ceiling, Multi-Vent air diffusing panels need not be moved, altered in any way, or even adjusted when partitions are put in place—or when they're relocated.

Multi-Vent introduces conditioned air through the perforations in standard acoustical ceiling pans, at low velocity. The air is gently diffused downward into the room. There is no "throw" or "blow" to bounce off nearby partitions.

A partition may actually bisect a Multi-Vent panel, without affecting comfort conditions in the surrounding area. Ceiling symmetry is never a problem; Multi-Vent is completely concealed.

Write for detailed literature and name of representative in your area.

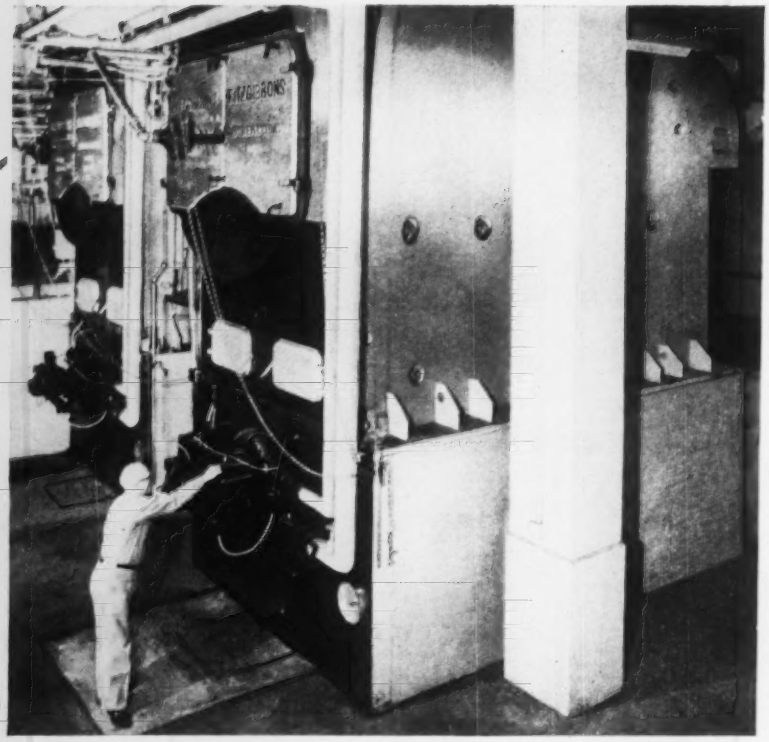
# multi-vent

DIVISION OF THE PYLE-NATIONAL COMPANY

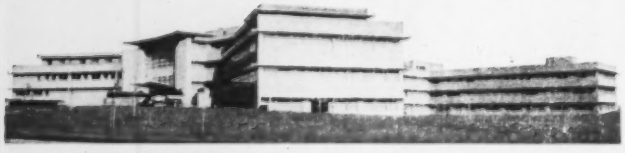
1373 N. Kostner Avenue, Chicago 51, Illinois

WHERE QUALITY IS TRADITIONAL

SALES AND ENGINEERING REPRESENTATIVES IN PRINCIPAL CITIES OF THE UNITED STATES AND CANADA—SEE LIST IN SWEET'S.



# Fitzgibbons Boilers
## working at
## Standard-Vacuum Oil Company



Standard-Vacuum Oil Company's sparkling new office building in White Plains, New York, features the latest in office layout and architecture, and the best in materials and equipment.

Part of this equipment—the heart of the heating system — is two Fitzgibbons "D" Type Boilers. These two DM 425, oil-fired boilers each supply 42,500 square feet of steam to provide economical, dependable heat and air conditioning.

Fitzgibbons "D" Type Boilers were selected for this installation because of their proved high efficiency, their strong, durable construction, and their ease of cleaning and maintenance.

Architect:
Eggers and Higgins, N.Y.C.
Consulting Eng: The Firm of Edward E. Ashley, N.Y.C.
Heat. & Air Cond. Contr's: Wolff & Munier, Inc., N.Y.C.

**For more information on this and other Fitzgibbons boilers write Fitzgibbons or contact your local representative.**

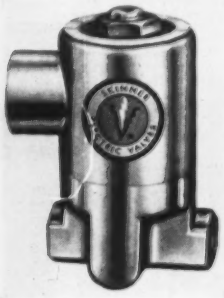
**Fitzgibbons**
**Boiler Company, Inc.**

SINCE 1886 MOST ECONOMICAL IN USE THE FITZGIBBONS BOILER

**New York Sales and Executive Office: 101 Park Ave., New York 17, N. Y.**
**Field Sales Office and Plant: Oswego, New York**
**Branches and Representatives in Principal Cities**
**Dept. 20**

FB 125

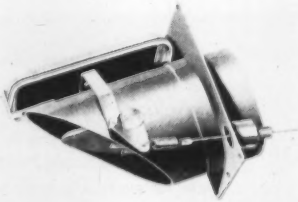
## EQUIPMENT DEVELOPMENTS
*Continued*



### Solenoid Valve . . .

. . .designed to provide large orifice capacity with high pressure differential—*Skinner Electric Valve Div., Dept. R260-HPAC, 105 Edgewood Ave., New Britain, Conn.*

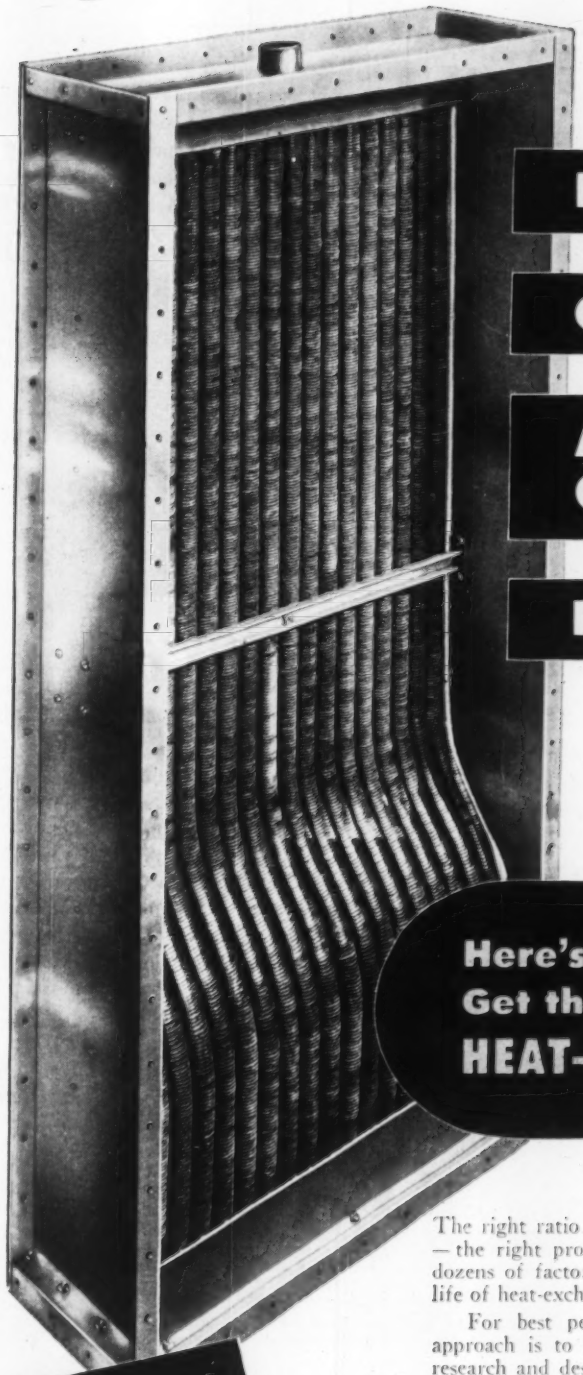
"R Series" of valves are normally open or normally closed with ¼ in. orifice and ¼ in. NPT and the ability to handle pressures 5 to 200 psi. Designed for use with all media such as air, water, oil and semi-corrosive media. Explosionproof design now available; high pressure valve with pressure ratings to 1000 psi and higher soon available. Valve weighs 1¼ lb. mounts directly to the line through ¼ in. NPT; stands 3¼ in. high with 2 in. between ports. It will handle temperatures from —65 to 180 F ambient and —65 to 150 F media. Stainless steel inernal parts encased in forged brass body.



### Air Flow Regulator . . .

. . .developed to provide accurate system balance of air distribution—*Trane Co., Dept. HPAC, La Crosse, Wis.*

Primary air delivery from induction "UniTrane" unit automatically held constant, regardless of supply duct pressure variations. Diaphragm controls damper blade in regulator to prevent fluctuations in air conditioner performance. Damper blade



**Heating?**

**Cooling?**

**Air Conditioning?**

**Process?**

## Here's How to Get the RIGHT Answer to your HEAT-EXCHANGE PROBLEMS

The right ratio of surfaces – the right materials – the right velocities – the right proportion between coil area and depth . . . there are dozens of factors that affect the efficiency, maintenance and service life of heat-exchange coils.

For best performance in your own application, the practical approach is to take full advantage of the unequalled engineering, research and design skill – the unequalled manufacturing and testing facilities – which Aerofin offers you.

To get the *right* answer – ask the Aerofin man.

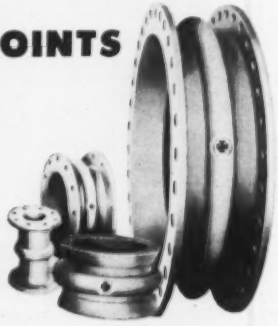
Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

# AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N. Y.

**YOU CAN *Profit* BY THE USE OF THESE *Practical* PRODUCTS OF GOODALL ENGINEERING . . .**

## *Rubber* EXPANSION JOINTS



Custom-built to meet specific requirements in sizes from ⅜" I.D. to 96" I.D., for pressures up to 125 lbs. P.S.I. and/or vacuum. Available in Right Angle Sleeve Types and "Flang-Lok"; single or multiple arch; tapered; offset; and rectangular.

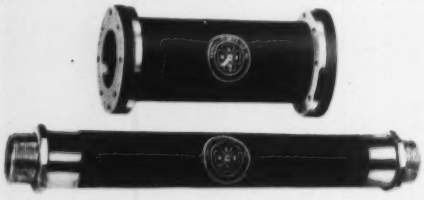
**LONGER SERVICE LIFE.** No deterioration through embrittlement or corrosion.

**SENSITIVE RESPONSE TO PRESSURE.** Only slightest pressure required to create movement in the joint, in any direction. Stress on metal pipe or other connected member reduced to absolute minimum.

**EASIER TO INSTALL.** Light in weight . . . short face-to-face dimensions . . . retaining rings or flanges quickly aligned and bolted. No gaskets required.

## *Rubber* VIBRATION —SOUND ABSORBER UNITS

Economical for use in many installations in place of expansion joints, for effective control of vibration and noise emanating from water pipes, air conditioning, heating and ventilating equipment. Strong, durable, resilient rubber compound, with wear and weather-resistant cover. Plain or with built-in wire reinforcement. Furnished with I.P.T. ferrules or steel split connecting flanges. Sizes ½" to 12" I.D., in lengths from 12" to 48".



## *"Rubberhide"* LININGS FOR CORROSION CONTROL

"RUBBERHIDE" Linings are compounded to assure long-lasting protection against the particular corrosive agents involved. They will repay many times their cost through extended life of products, parts or equipment. Produced with either rubber or neoprene as the base material. Processed to objects shipped to our Linings Plants in Trenton, Chicago or Houston; or, when the objects are too large for such shipment, or the work involves fixed plant equipment, experienced field crews do the processing "on location".

***"If it's GOODALL, it MUST be Good!"***

Contact Our Nearest Branch or Write for Catalog

*Standard of Quality—Since 1870* HOSE · BELTING · FOOTWEAR · CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

**GOODALL *Rubber Company***

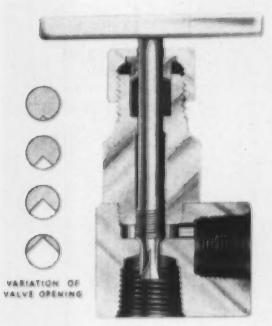
**GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.**

BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES. IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.


## EQUIPMENT DEVELOPMENTS

*Continued*

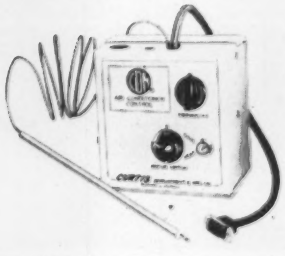
action regulated by calibrated adjustment rod, which may be set externally. Air delivery maintained within 5 percent, says manufacturer. Constructed of corrosion resistant materials. Built in 3, 4 in. sizes for left or right hand air supply to conditioners.




### Orifice Valve . . .

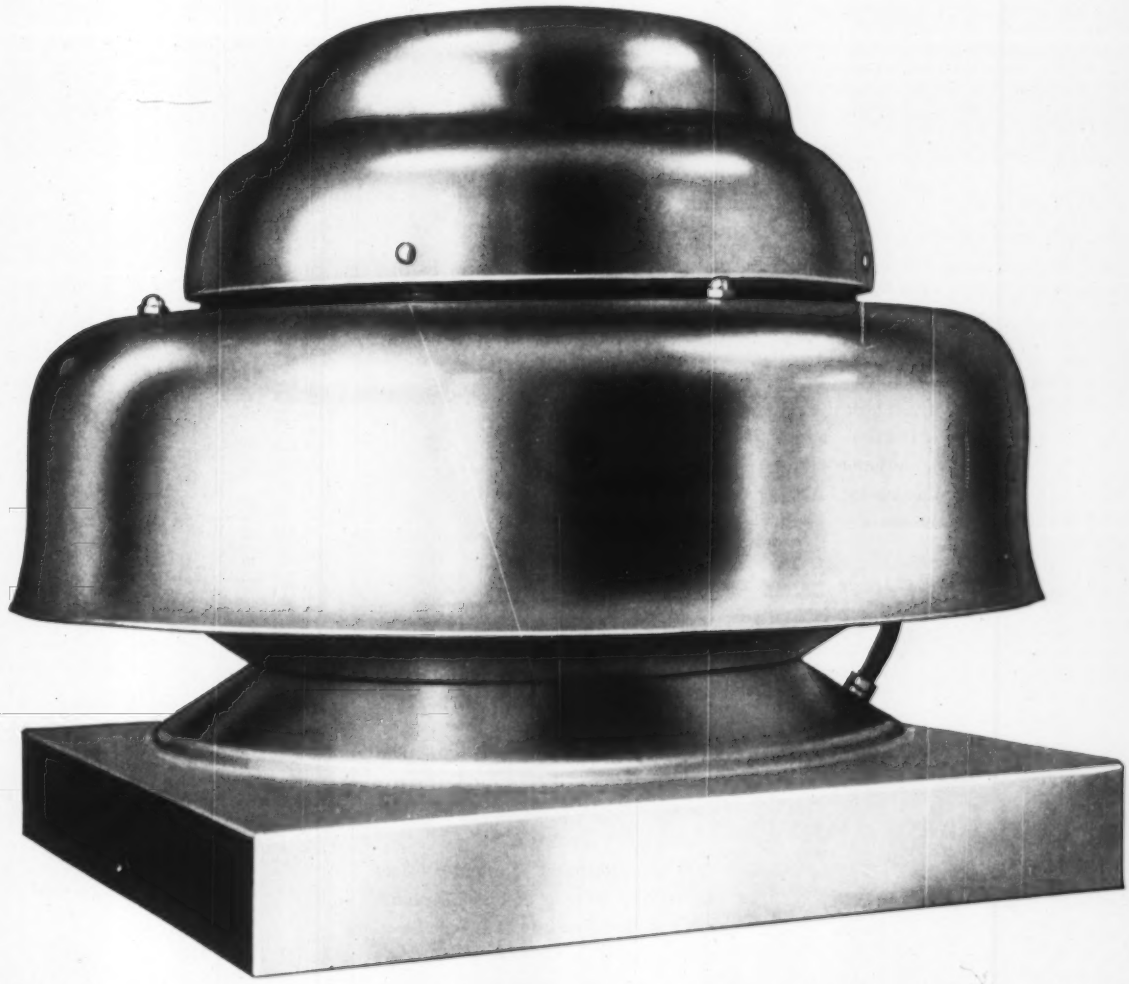
. . . developed for accurately controlling flow of high pressure liquids, gases—*General-American Valve Co., Dept. HPAC, P. O. Box 444, Corona del Mar, Calif.*

"Veegroo" orifice valve manufactured in standard sizes to 1 in. Pressure ratings for bar stock valve: 3000, 10,000 psi. Available in carbon steel, 303, 316 or 416 stainless steel, Alloy 20, Monel, aluminum. By moving plug with tapered slot in and out of circular opening, flow of fluid or gas is controlled by area of slot at head of opening. Available in bar stock type, cast bronze, large iron body, large high pressure steel body, as well as custom designs.

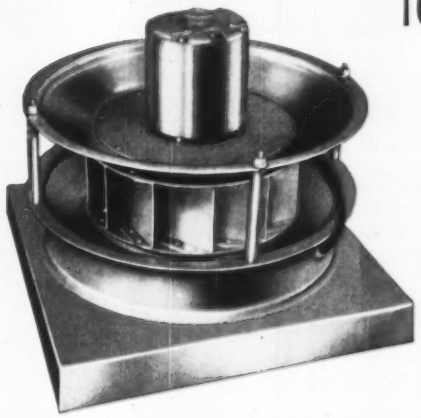


### Motor Speed Controls . . .

. . . engineered for shaded pole and permanent split capacitor fractional hp motors for air conditioning, ventilating, heating applications—*Curtis Development & Mfg. Co., Dept.*



# SPECIFY new **Spunaire** by **Swartwout** for efficient, low cost ventilation



The new Swartwout Spunaire is designed for small area ventilation jobs. High performance and quality are engineered into this direct drive centrifugal ventilator. Quiet, efficient operation, light weight and easy accessibility to motor fan unit are all combined in an attractive, low silhouette. Entire unit is made of heavy gauge aluminum, including the non-overloading centrifugal wheel.

Write today for complete information.

- ***Low initial cost plus low maintenance.***
- ***All aluminum construction.***
- ***Quiet, efficient operation.***
- ***Low modern contour.***
- ***5 sizes, 29 capacities from 300 to 4,200 CFM.***

**The Swartwout Co.**
**Ventilation Engineering**
18568 Euclid Avenue Cleveland 12, Ohio

## EQUIPMENT DEVELOPMENTS

*Continued*

*HPAC, 3266 N. 33rd St., Milwaukee.*

Speed control with tapped reactor produces required voltage drop by introducing impedance (at desired percentage of full voltage) in series with alternating current motor where speed changes with applied voltage. It is step-type control with three speeds—high, medium, low. Unit consists of reactor, manual switch. Semi-automatic speed control for air conditioning includes basic speed control unit with adustable motor speed control switch, summer-winter switch, adjustable thermostat. Variety of enclosures, mountings available.

### Gate Valves . . .

. . .in newly designed line—*Crane Co., Dept. HPAC, 836 S. Michigan Ave., Chicago 5.*

Bronze, 200 lb gate valve has cylindrical body, giving greater resistance to line distortion, internal pressure. Also has chromium steel alloy body seat rings, easily replaced wedge disc. Offered in rising stem, non-rising stem patterns in sizes ¼ through 3 in.

### Flow Switch . . .

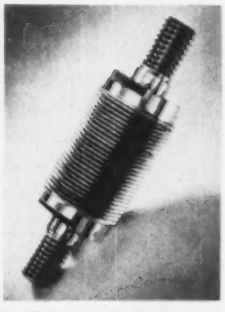
. . .developed to activate signal, pump, burner, alarm, meter, similar equipment—*McDonnell & Miller, Inc., Dept. HPAC, 3500 N. Spaulding Ave., Chicago 18.*

Any flow of liquid in pipe moves paddle, closes "FS4" switch to complete electric circuit which remains closed until flow ceases. Reverse acting type also available to open circuit when flow starts, close it when flow stops. Sensitivity to flow can be adjusted. Can be installed in 1 in. pipe tapping. Paddle, assembled in 1 in. segments, can be adapted to fit 1 in. or larger pipe sizes. Packless construction features heavy phosphor bronze bellows. All operating parts are brass, copper or bronze. Switch is magnet assisted, snap action design. Available in four models.

### Dewpoint Indicator . . .

. . .designed to permit continuous dewpoint measurement over wide temperature range—*Weighing & Control Components, Inc., Dept. HPAC, 309 Lincoln Ave., Hatboro, Pa.*

"W-C" dewpoint indicator does not require purging of test gas chamber each time reading is taken. Gives readings over dewpoint temperature range of −100 F to maximum ambient of 110 F. Readings expressed in deg F, which may be converted to actual moisture content by means of chart with unit. Unit is powered by self-contained battery. Gas connections made with ⅛ in. pipe fittings.



### Welded Metal Bellows . . .

. . .engineered to provide accuracy, life over range of critical operating conditions—*Bridgeport Thermostat Div., Robertshaw-Fulton Controls Co., Dept. HPAC, 155 Hill St., Mil-*

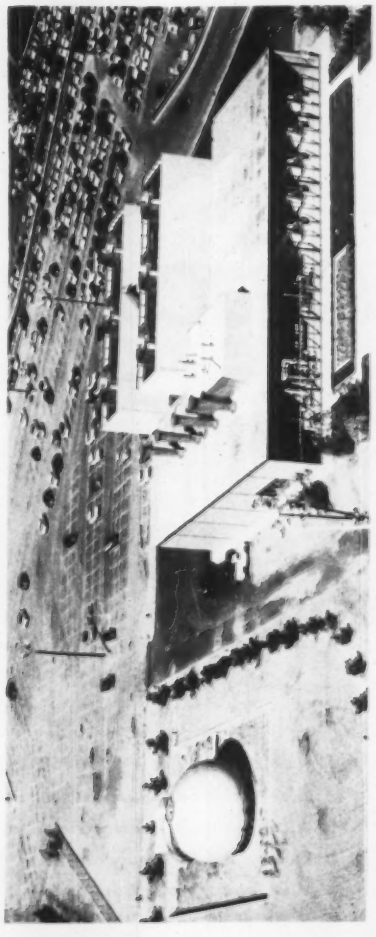
**NEW YORK INTERNATIONAL AIRPORT — CENTRAL HIGH TEMPERATURE HOT WATER HEATING PLANT.**

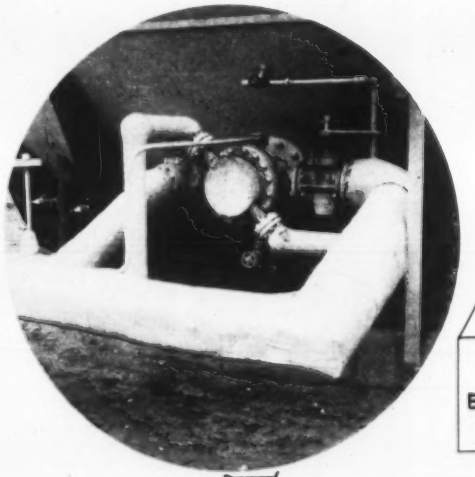
The diagram and photographs below show where YULA provided all the heat transfer units needed for handling No. 6 oil and generation of steam from H.T.H.W.

Preheating of No. 6 oil, using a combination of H.T.H.W. (380°F) and steam, can produce problems. Not so when YULA's complete line is used.

This installation is typical of the many fine buildings now using YULA equipment.

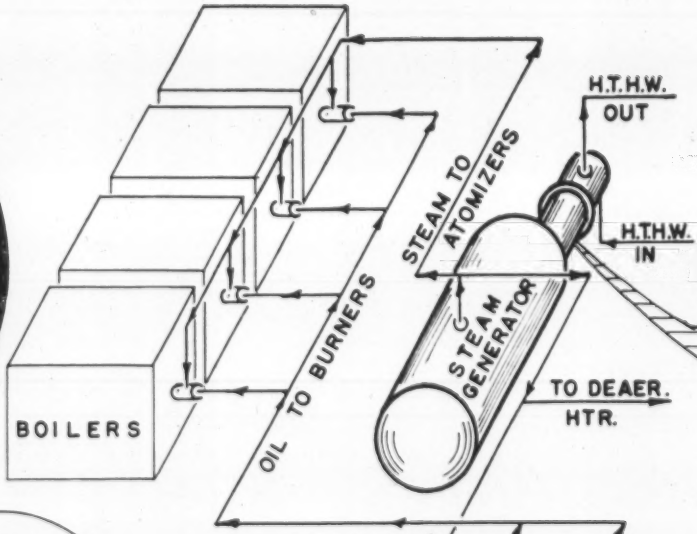
**SPECIFY AND BUY YULA FOR THE VERY BEST!**

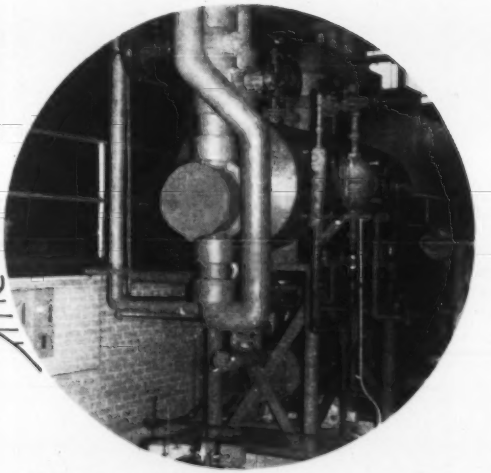




**SUCTION FUEL OIL HEATER**

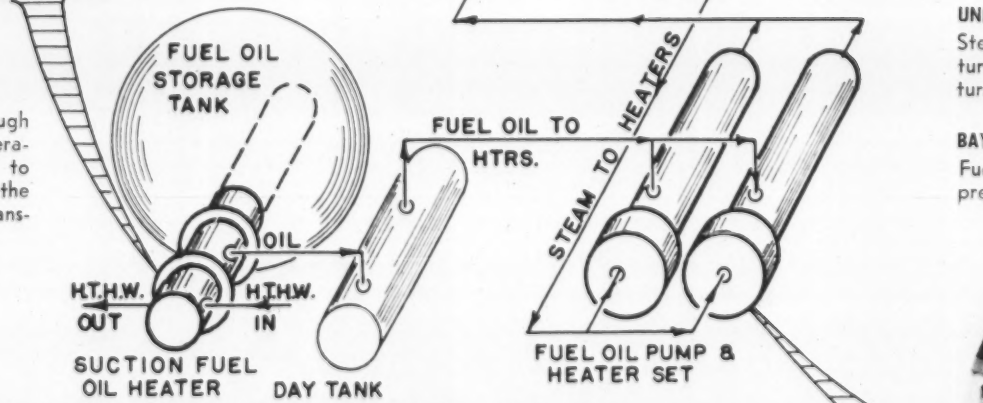
Fuel oil heated through shell with high temperature water in tubes to lower the viscosity of the oil to permit pump transfer.



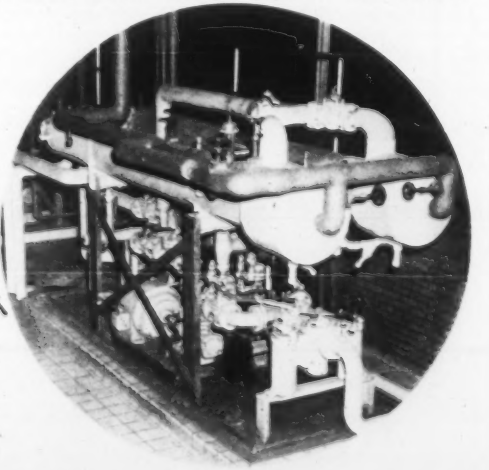
**UNFIRED STEAM GENERATOR**

Steam is generated in shell using high temperature hot water in tubes. Steam dome and moisture eliminator included in this unit.




**BAYONET-TYPE "B" OIL HEATER**

Fuel oil heated through baffled shell using high pressure steam through Bayonet tube bundle.

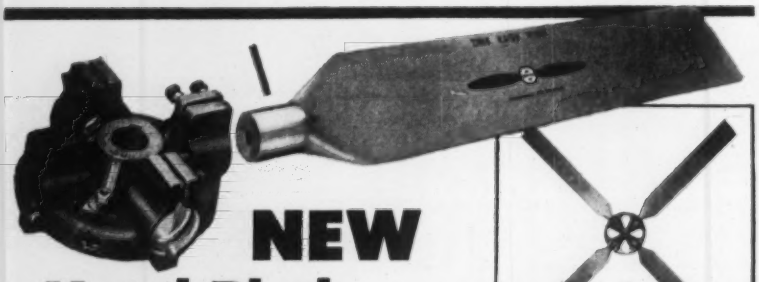


"This Show Place", "Aerial Gateway to the World", demanded equipment of the highest calibre. Yula products were the natural selection for this important installation. Our policies feature, First Class Engineering, fine craftsmanship, efficiency of operation, and unsurpassed service.

Built by the Port of New York Authority Architects, Skidmore, Owings & Merrill. Consulting Engineer, Seelye, Stevenson, Value and Knecht. Mechanical Contractor, Almirall & Co., Inc., and Norman Heating Co.

**Yula**
HEAT-TRANSFER EQUIPMENT

YULA WATER HEATERS, INC. 330 BRYANT AVE., NEW YORK 59, N. Y.



# NEW Metal Blade Aeromaster* Fan

AEROMASTER fans 54" to 22' for cooling towers and radiator-type coolers.

## Lasts Longer • Costs Less

Efficiency . . . economy . . . durability—three important standards—are yours in the AEROMASTER fan.

AEROMASTER fans are efficient because they embody advanced aerodynamic principles. True airfoil blade sections give maximum air delivery.

AEROMASTER fans are economical because adjustable pitch angle of the blade permits a flexibility of setting which enables you to decrease fan load to an accurate minimum horse-power requirement. Design features reduce labor and installation costs.

AEROMASTER fans are durable because they are made from corrosion resisting, silicon-magnesium, aluminum alloys with high tensile strength, fine grain structure and increased endurance limit.

For more details write to KOPPERS COMPANY, INC., Aeromaster Fan Dept., 6807 Scott Street, Baltimore 3, Md.

*Koppers Trademark

KOPPERS

Aeromaster Fans

*Engineered* Products Sold with *Service*

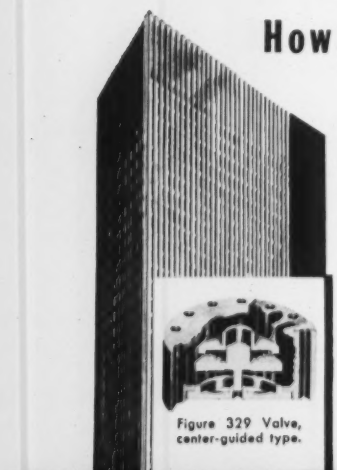


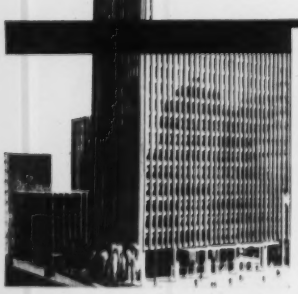
Figure 329 Valve, center-guided type.

# How to silence 38 stories of piping

In the new Seagram Building in New York, Williams-Hager Silent Check Valves control water hammer. They silence and protect piping by operating instantly when flow reversal starts or when flow is zero. Just one of hundreds of outstanding buildings protected by Williams-Hager Valves.

***Write for Bulletins***

—No. 654 on Valves, No. 851 on Cause, Effect and Control of Water Hammer



WILLIAMS • HAGER

Silent CHECK VALVES

*Architects:* Mies van der Rohe & Philip Johnson. *Associate Architects:* Kahn & Jacobs. *Consulting Engineers:* Jaros Baum & Bolles. *General Contractor:* George A. Fuller Company. *Plumbing Contractor:* Eugene Duklauer Inc.

**THE WILLIAMS GAUGE CO., Inc.**

155 Stanwix St. • 2 Gateway Center • Pittsburgh 22, Pa.

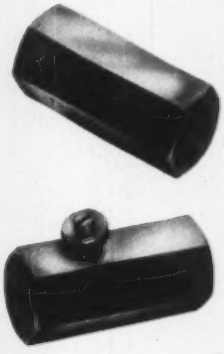
*Our 72nd Year . 1886-1958*


## EQUIPMENT DEVELOPMENTS

*Continued*

*ford, Conn.*

Sizes of welded metal bellows assemblies range ¼ to 18 in. outside diam. Recommended applications: fuel controls, oxygen regulators, steam traps, packless valve seals, temperature and pressure sensors, other instrumentation. May be designed with flat, spherical, stepped, other specially shaped plates as thin as 0.003 in. ± 0.001 tolerance. Characteristics and advantages include: close dimensional tolerance along free length; closer performance tolerance; operation at higher pressures, temperatures with large effective areas, lower spring rate; custom engineering to meet environmental specifications; electronic determination of stress, strain in analysis of bellows construction.



### Flow Control Valves . . .

. . . for hydraulic, gas applications—*True-Flo Div. of Mystic Machine Co., Inc., Dept. HPAC, 79 Bow St., Everett 49, Mass.*

"Straight-through" ball-valve design enables increased flow, greater dependability, reduction in friction, says company. Has metal-to-metal seats, "free-ball" mounting. Valves are female threaded to dryseal specifications in standard IPS ⅛ to ¾ in. Available from stock in brass; in steel, aluminum, stainless and special alloys to order. Pressure ranges to 2000 psi. Adaptable to extremely high or low temperatures, because of absence of internal gaskets, springs, hinged parts. Adjustable before, during, after installation.

# ROBVON

## BACKING RINGS

**APPROVED FOR WELDED PIPE, VALVES, AND FITTING JOINTS**

- ✓ Nub diameter automatically sets welding for root pass
- ✓ Forms perfect welded joint eliminating slag and icicles
- ✓ Allows complete penetration and fusion
- ✓ Eliminates the necessity of tack welding
- ✓ Radiographs a perfect certified weld

**Available in Carbon Steel, Wrought Iron, Chrome Alloys, Stainless Steel, Aluminum and Copper**

**TYPE CCC** Designed for quick easy alignment of pipe where the variation in inside diameters is relatively great. Chamfered NUBS allow close tolerance fit-up and CLEAN STRIKE OFF. The ROBVON NUB conforms to the diameter of weld rod. Robvon rings are beveled to assure non-restricted fluid flow.

**TYPE CC** Designed to allow quick easy alignment of pipe where the inside diameters are slightly out of round. The welder has the choice of "STRIKING OFF" the NUBS or leaving them intact to be melted into the weld mass of the first root pass.

**TYPE C** Designed for precise tolerance fit-up. Type "C" NUBS conform to the diameter of the weld root. The NUBS melt with the metal to give complete penetration and fusion.

**WRITE FOR FULL INFORMATION**

**ROBVON ALSO MANUFACTURES MACHINED RINGS TO CUSTOMER'S SPECIFICATIONS. ALL FABRICATED SOLID MACHINED RINGS X-RAYED.**

**ROBVON**
**BACKING RING COMPANY**

**675 Garden Street** **Elizabeth, N. J.**

# How to stop noise, vibration and "hammer" in water lines

**THE ORIGINAL SOUNDZORBER** expressly designed for use in air conditioning water lines . . .

A wire-reinforced wrapped fabric rubber pipe, SOUNDZORBER can be used continuously in water lines at up to 250 psi working pressure (safety factor: 5 to 1).

Smaller sizes ½" to 3" available with male I.P.T. bronze fittings. Larger sizes available with integral full-faced rubber flanges backed up with Series 15 or Series 30 steel flanges. No metal-to-metal contact.

**SOUNDZORBER** is but one of a complete line of Finn vibration controls. Finn has control devices for every vibration problem in your field. Write for complete information.

FINN

VIBRATION FINNFLEX CONTROL

INDUSTRIAL DIVISION

**T. R. FINN & COMPANY, INC.**

**200 Central Ave., Hawthorne, N. J.**

*REPRESENTATIVES wanted. If interested write or call, describing qualifications.*

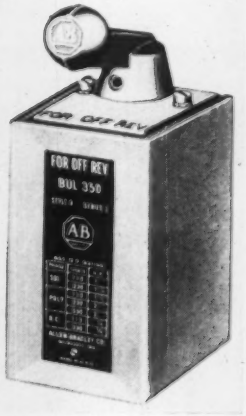

## EQUIPMENT DEVELOPMENTS

*Continued*

### Snap Valve . . .

. . .to be used for control of air, gas, liquid pressure line—*Seamon Snap Valve Co., Dept. HPAC, 175 Mechanic St., Worcester 8, Mass.*

Brass plunger of valve slides in all bronze casing, slotted for flow or shutoff by light pressure. Plunger ends colored green for open and red for close. Synthetic rubber o-rings form seal between casing and plunger. Valve has direct airflow with full capacity and will not block, choke, retard flow, says company. Available in 2, 3 way types, ⅜, ½, 1 in.




### Drum Switch . . .

. . .developed for starting, stopping, reversing small a-c and d-c motors—*Allen-Bradley Co., Dept. HPAC, 136 W. Greenfield Ave., Milwaukee 4.*

"Bulletin 350" switch furnished in surface mounted NEMA Type 1 enclosures or with oiltight cover plate for cavity mounting in machine base. Wraparound cover exposes switch

(*Continued on page 214*)

the quality tells . . . the quality sells

# new JANITROL AIR COOLED packaged air conditioner

Flexible and compact—
fastens to ceiling or
stands upright on floor . . .
adaptable for duct system.

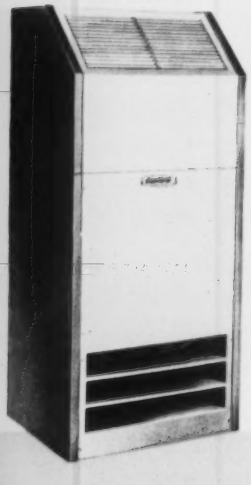
*Easy solution to a wide range of residential and commercial cooling problems . . .*

# *new* JANITROL COMPACK

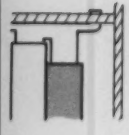
## *"packaged" waterless cooling conditioner*

This versatile new cooling conditioner lends itself to an exciting variety of cooling applications . . . meets your need for maximum cooling efficiency in little or no floor space at all!

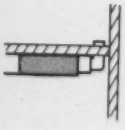
It is designed for free air discharge or use with a duct system . . . may be suspended overhead or positioned on the floor. *Waterless* operation assures quieter, thriftier operation—establishes a new concept of cooling performance. The complete refrigeration assembly is housed in a remote air-cooled unit that's engineered for comfort-cooling with outside air temperatures to 125° F.



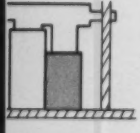
For your next residential or commercial job, provide controlled, high-efficiency cooling free from objectionable noise and drafts with the Janitrol Compack . . . one of Janitrol's complete line of conditioners for cooling and heating-cooling applications. Ask your Janitrol representative for full details.



Janitrol "Compack" in parallel with warm-air "up-flow" furnace completes a year 'round comfort system.

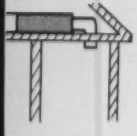


In basements with low headroom, "Compack" saves space—may be suspended from joists and utilize existing warm air ducts through a by-pass system.



Janitrol "Compack" blower coil unit with up-flow furnace in first floor closet or utility room.

"Compack" installed overhead in an office. Whisper-quiet, it never intrudes to disturb busy people.



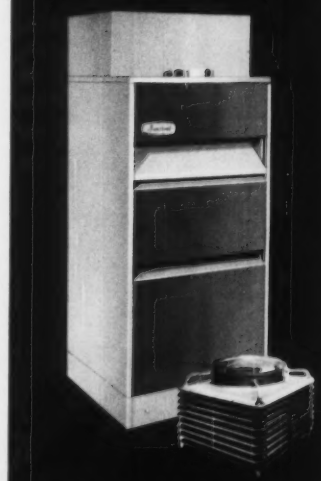
Janitrol "Compack" in attic—cools entire house through small ducts feeding diffusers near ceiling of rooms below.

"Compack" feeding a duct system in modern store. Several "Compack" units can be combined to meet a variety of cooling needs—provide zone control where desired.

"Compack" installed upright on the floor in restaurant. Draftless, free-air discharge.

**ARCHITECTS, ENGINEERS AND CONTRACTORS INFORMATION SERVICE**

Write today for complete specifications on Janitrol cooling and heating in buildings of every type. There's no obligation.



## JANITROL WIN-SUM-MATIC

### Year 'round conditioner

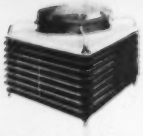
Combines thrifty gas heating, waterless cooling in little as 3-3/5 sq. ft. of floor space. Famous 20 year warranted Dura-Tube heat exchangers. Unique by-pass gives correct air flow for heating and cooling without seasonal adjustments. Air cooled Pride O' Yard unit is low, sleek, efficient . . . ADD-ON cooling option—install for heating only, add cooling later. Upflow and downflow models, 80,000 to 200,000 btu./hr. (to 120,000 on down flow) heating, 22,000 to 76,000 btu./hr. cooling capacities*.

### SRA add-on cooling

Adapts most any warm air furnace for thrifty, efficient central cooling. Cooling coil mounts in duct, beautiful air cooled Pride O' Yard unit goes outside. Powerful, quiet performance with outside temperatures to 125° F. Easy to install. Waterless operation eliminates plumbing, sewage, water supply problems. 22,000 to 76,000 btu./hr. Capacities*.

### Gas-fired Duct furnaces

Designed for installation in a duct where the air is circulated by a separate blower. Especially adaptable for industrial heating applications in combination with cooling. DUCT Series 55 in five sizes from 85,000 to 225,000 btu./hr. Series 75 in sizes 200,000 and 300,000 btu./hr. may be combined to provide unlimited capacity range.



**CAPACITIES***

SRA-7—22,000 btu.
SRA-9—35,000 btu.
A-401 and 403—47,500 btu.
SRA-11—58,500 btu.
A-603—76,000 btu.

*95° F. Dry Bulb air entering condenser, 80° F. Dry Bulb, 67° F. Wet Bulb air entering evaporator, approximately 400 CFM per 12,000 btu.

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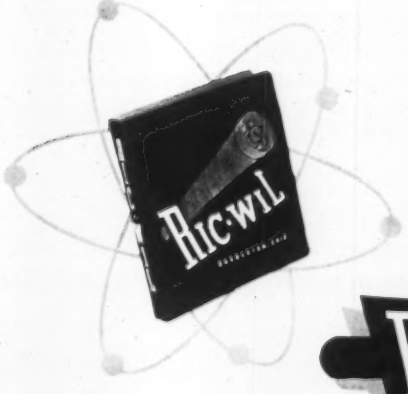
# Ric-wiL serves the nation's first nuclear reactor designed for medical research and treatment . . .

Malan Construction Corp. of New York City as prime contractor, is building for the Atomic Energy Commission the Nation's first medical research center containing a nuclear reactor designed specifically for medical research and therapy. The entire medical center, including the reactor, is scheduled for completion in 1958 at a cost of approximately $6,000,000.

Ric-wiL prefabricated piping was specified and installed to handle the underground steam distribution. Ric-wiL, Incorporated is proud to be a part of the nation's peace time program in Atomic development.

Write for the illustrated catalog covering the complete line of Ric-wiL systems available.

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## EQUIPMENT DEVELOPMENTS

*Continued from page 214*

mechanism for wiring; terminal screws accessible from front instead of side. Edge of enclosure base raised so cover can be slipped off or on directly from front. Available for 1½ hp 110 volt, 2 hp 220 volt, single phase motors; 2 hp 110-220-550 volt polyphase motors; ¼ hp 115-230 volt direct current motors.

### Relief Valves . . .

. . . with brass body, 18-8 stainless steel spring, brass disc holder with molded silicone rubber disc—*Crane Co., Dept. HPAC, 836 S. Michigan Ave., Chicago* 5.

Three brass combination temperature-pressure relief valves and one brass pressure relief valve are intended for water heaters, storage tanks. Three combination valves have thermal discharge rating of 175,000 Btu per hr. "No. 1143 and "No. 1163" are fitted with fusible plug in disc holder. Plug has melting point of 210 F. In case of pressure rise without temperature rise, pressure rise offsets spring tension, allows discharge of overpressure. "No. 1147" combination valve has thermal element responsive to temperature to overcome spring tension on valve disc. "No. 1169" pressure relief valve should be installed directly into tank tappings or in hot or cold water lines, has conventional spring-loaded disc.

### Pipe and Duct Insulation . .

. . . in line of glass fiber industrial insulating products—*Eagle-Picher Co., Dept. HPAC, American Bldg., Cincinnati* 1.

"Superglas" line of insulating materials cover range of temperatures from sub-zero to 2300 F. Developed for use on piping, ducts, industrial equipment.


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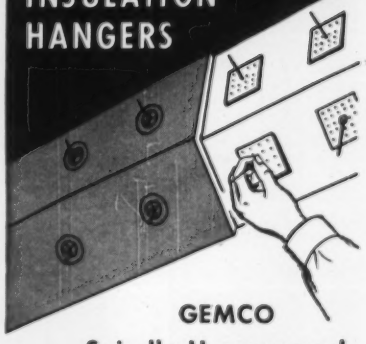
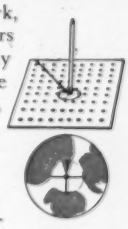
with these dependable
INSULATION
HANGERS

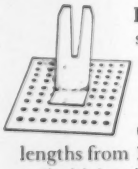


**GEMCO**
**Spindle Hangers and W-A Self-Locking Washers**



Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed . . . with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.

**GEMCO Pronged Hangers**



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1 3/16" to 6⅞") bend over to hold insulation firmly in place.

**TUFF-WELD Nylon Hangers**

Two-piece hangers . . . with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

**TUFF-BOND** Quik-Set Adhesive (for smooth or slightly irregular surfaces) and General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

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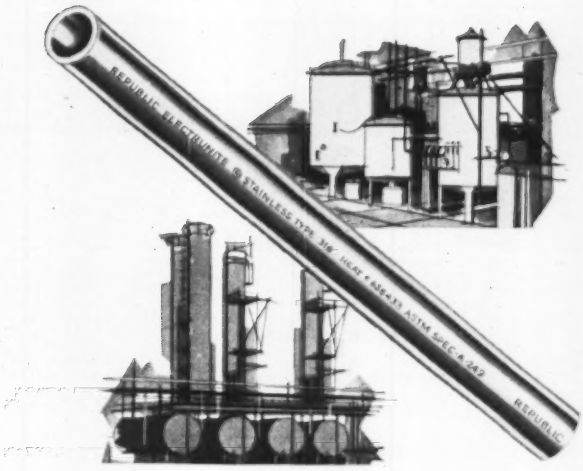


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## STAINLESS STEEL TUBING AND PIPE

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ELECTRUNITE is easy to install, can be welded, threaded, or used with compression couplings. ELECTRUNITE assures uniformity of wall thickness, strength ductility, concentricity, diameter, and other physical and mechanical properties for dependable, predictable workability.

Your Republic ELECTRUNITE distributor—your local steel service center—stocks only the highest quality stainless steel pipe and tubing. Call him today or send coupon for more information.

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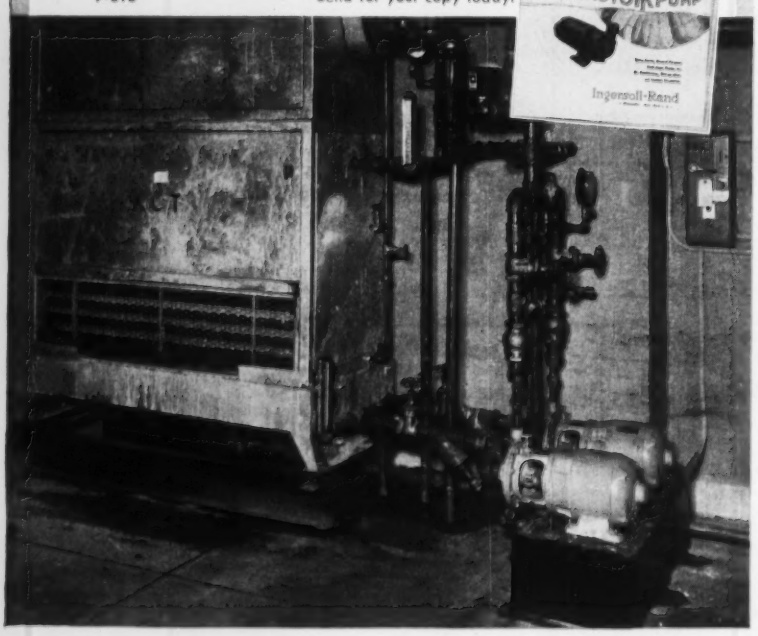



## EQUIPMENT DEVELOPMENTS

*Continued*

### Stud Welder . . .

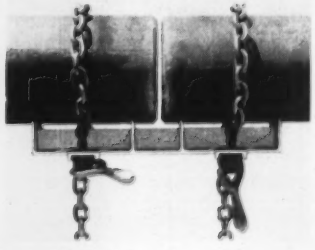
. . . with new method requiring no special power sources—*Nelson Stud Welding Div. of Gregory Industries, Inc., Dept. HPAC, Lorain, Ohio.*

Studs to ¼ in. diam may be welded to galvanized duct work as light as 26 gage with "NS-10" stud welding gun. Conventional welding generator, rectifier or battery unit supply power. Studs can be welded at rate of 200 to 400 per hr.

### Cork Gaskets . . .

. . . designed to eliminate leakage and seepage of liquids and gases—*Armstrong Cork Co., Dept. HPAC, West Liberty St., Lancaster, Pa.*

"Uniphase Cork" is made with continuous phase elastomeric binder that surrounds, imbeds cork particles, forming impervious barrier to fluids, according to manufacturer. Resistant to fungus attack, has ozone resistance. Seals at flange pressures 100 to 2000 psi.



### Pipe Clamp . . .

. . . for aligning, holding pipe during welding—*Jewel Mfg. Co., Dept. HPAC, 1841 University Ave., St. Paul 4, Minn.*

New aluminum pipe clamp permits quick assembly and removal after pipe joint is welded. Clamps for standard pipe sizes from ½ in. to 8 in. weigh 7 lb. Clamps for pipe sizes from 8 in. to 16 in. weigh 20 lb.

# New Concept in Construction Fastening!

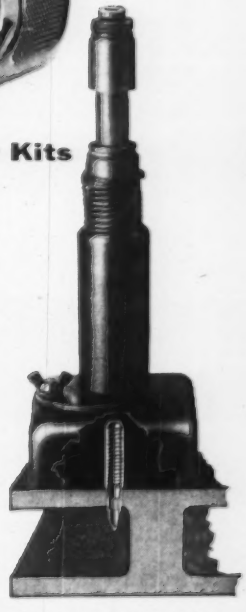
## REMINGTON Power-Mate* BASIC UNIT

### . . . plus choice of 4 interchangeable Stud Driver Kits

**K-1. CAPTIVE STUD KIT**—designed to prevent free flight of studs when base material is inadequate. Used with "Power-Mate," this is safest Stud Driver ever designed.

**K-2. LIGHT-DUTY KIT**—produces all-purpose tool. Handles 80% of your fastening in concrete or steel. K-1 and K-2 use ¼" diameter Remington Studs and 22 caliber Power Loads.

**K-3. MEDIUM-DUTY KIT** permits use of ⅜" diameter Remington Studs with low-cost 22 caliber Power Loads. This assembly gives top performance . . . economically.



**K-4. MEDIUM- AND HEAVY-DUTY KIT** for toughest fastening jobs. Designed for use with ⅜" diameter Remington Studs and scientifically graded 22 or 32 caliber Power Loads.

### Most versatile tool ever designed for fastening wood or metal to concrete or steel

Now you can have the power you want, the stud size you need with the new Remington "Power-Mate." The tool is easy to use. Just a squeeze of the trigger is all it takes to anchor wood or metal sections to concrete or steel. No pre-drilling, no outside power connections required!

The Remington "Power-Mate" is flexible, too. Permits use of ¼" or ⅜" diameter alloy steel studs and 22 or 32 caliber Remington Power Loads to furnish driving force.

Take the "Power-Mate" Basic Unit, attach the Stud Driver Kit of your choice—and the tool is ready to use! It will handle any fastening job—light, medium or heavy duty. That's why the Remington Stud Driver is the most versatile construction fastening tool ever designed!

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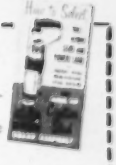
Please send free booklet on the Remington "Power-Mate."

☐ I am especially interested in the Captive Stud Kit.



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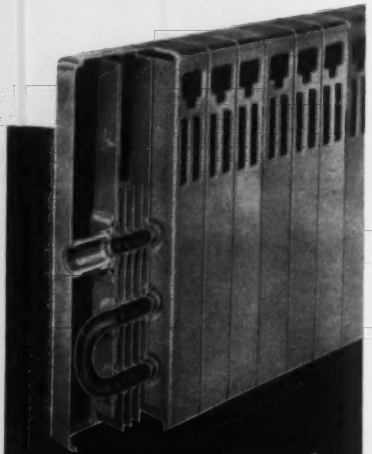
## from SHAW RADIATORS



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Shaw Radiators "heat-condition" a room for *natural* comfort by delivering *radiant* heat that warms solid objects, and *convected* heat to warm the atmosphere.

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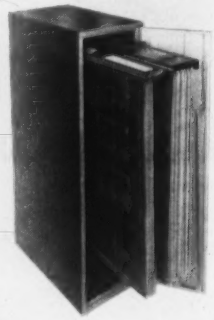
## EQUIPMENT DEVELOPMENTS

*Continued*

### Scale Remover . . .

. . . developed to remove hard water scale, rust algae, similar deposits from air conditioning towers, evaporative condensers — *Key Chemicals, Inc., Dept. HPAC,* 2416 *E. Huntington St., Philadelphia* 25.

"Key-Mix 28" is a dry, powdered inhibited acid blend intended for use as an acid cleaner. It is broad spectrum corrosion inhibitor for the protection of metals in system against corrosion and pitting during the acid cleaning process. Can be used hot or cold; no corrosive fumes.



### Vertical File . . .

. . . for individual filing of single large sheets such as blueprints, drawings, plans, maps.—*Plan Hold Corp., Dept. HPAC,* 5204 *Chakemco St., South Gate, Calif.*

New file consists of a wall mounted bracket accommodating 150 aluminum hangers. Sheet can be slipped on or off hanger by attaching tubular tape.

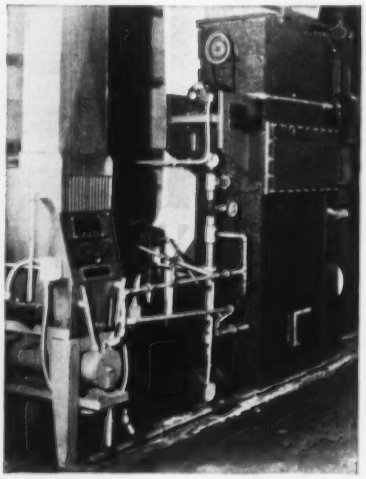
### Tubing Bender . . .

. . . developed to bend thin wall copper, aluminum tubing to 180 deg at speeds to 900 bends per hr — *Paul Machine Tool Div. of Paul Machine Tool & Die Works, Dept. HPAC,* 4600 *S. Kedzie Ave., Chicago* 32.

"Bend-Ex S" has fully automatic head, feed, table return and quick change angle selector, says company. It is completely air operated. Produces bends on 0.017 wall tubing, will handle tubing to 40 ft long, ¼ in. to ⅝ in. diam on minimum centerline radii, making coils to 24 x 24 in. from single tube.


# EXACT CONTROL

## of Moisture Content To Improve your Product or Protect Your Materials or for Processes or Tests



● This Niagara Air Conditioning Method dries air directly and measurably, using a moisture-absorbing liquid spray. It makes humidity control a separate function from lowering or raising temperatures and gives you precise control with thermostats alone; no moisture-sensitive devices are needed. You have simpler, more trustworthy, less expensive control instrumentation. Niagara precise-control installations have the best record for reliability.

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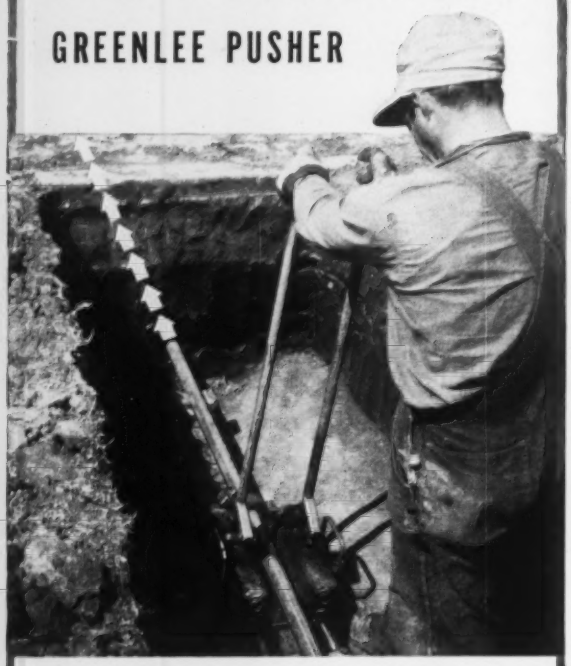

Save hours of time, cut job costs with this quick, easy way of installing underground pipe. With a GREENLEE Hydraulic Pipe Pusher, *one man* pushes pipe *under* streets, walks, tracks, lawns, floors, and other obstacles. No costly tearing up of paving . . . eliminates extensive ditching, as just a short trench accommodates the Pusher. No tedious tunneling, backfilling, tamping, repaving. Compact, portable, powerful. Often pays for itself on first few jobs. Thousands in use for big savings of time and labor. Two models: one for ¾ to 4" pipe, one for larger pipe, concrete sewer pipe, drainage ducts. Write for facts today.

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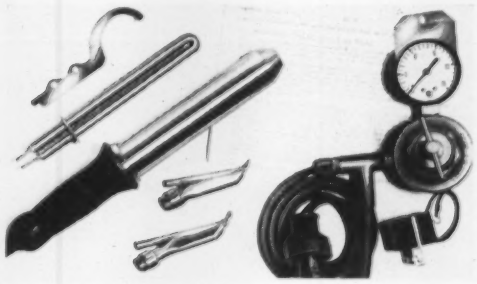
## EQUIPMENT DEVELOPMENTS

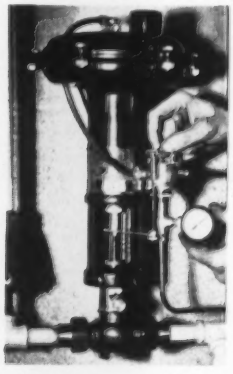
*Continued*



### Plastic Welders . . .

. . . with all parts, including tips, made of stainless steel — *Laramy Products Co., Dept. HPAC, 90 South St., Hingham, Mass.*

"Kamlar Model HT" is fitted with standard welding tip or with high speed tacking tip that permits rodless tacking. With addition of flat tip, v-tip and strip feeder, model can be used to heat seal vinyl strip on plasticized vinyl tank linings, etc. "Kamlar Model HS" has high speed tips (for 1/8, 5/32, 2/16 in. rod) that hold, feed, guide rod automatically, permitting one hand operation at speeds to 50 in. per min, says manufacturer. Handles of both models are air cooled, electrically insulated.



### Pneumatic Relay . . .

. . . developed to provide accurate control of pneumatic motors and valves—*Powers Regulator Co., Dept. HPAC, 3434 Oakton St., Skokie, Ill.*

"Sta-Put" relay is said to counteract the effects of friction and load factors which prevent a pneumatic motor or valve from responding properly, can be used for tune up or adaptation to increased load conditions. Relay attaches directly to motor or valve; no drilling or fabricated parts required. Adjustable between 2 and 15 psi. Can be fitted to 3, 4, and 6 in. pneumatic motors and to 8 and 12 in. pneumatic valves; one relay can handle multiple installations of four 6 in. or ten 4 in. motors. Normal supply air pressure is 20 psi; maximum air pressure is 25 psi. Operates between 20 and 180 F.

# in easy-to-handle **dry** form

**Cleaners based on Du Pont Sulfamic Acid are safer, more convenient, non-fuming . . . dissolve in water to form effective, low-corrosive solutions**

Now . . . powerful acid cleaners you handle *dry* with no hazardous fumes, no acid splashing! When added to water, these cleaners form solutions equal to hydrochloric acid in penetrating power, yet they're far less corrosive. The key to these unusual properties is Du Pont Sulfamic Acid.

Cleaners based on sulfamic acid cut downtime to a minimum during scale removal. In many situations, because there are no fumes, cleaning can be done with no interference to normal operations. And, because these cleaners are easier to handle and store, their use results in lower labor and storage costs.

We'll gladly send you additional information on sulfamic acid-based cleaners, and the name of formulators who offer these new compounds. Just mail the coupon below.

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Please send me ☐ sulfamic acid general equipment cleaning bulletin; ☐ air conditioning bulletin; ☐ names of formulators offering cleaners based on Sulfamic Acid.

*Name*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

## EQUIPMENT DEVELOPMENTS

*Continued*

### Pipe Thread Compound . . .

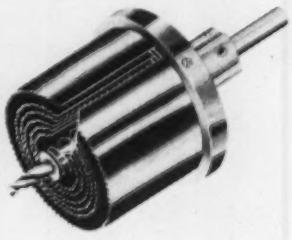
. . . with biologically inert chemical resistance—*Abbott & Biddle Co., Dept. HPAC, 2417 Federal St., Philadelphia* 1.

"Abbott & Biddle 25's" lubricating qualities are said to prevent galled threads, permit easier pipe joining that can be dismantled after prolonged exposure. Can be used with alkalies, acids and solvents at temperatures to 500 F. Recommended for use on chrome, chrome plate, nickel, steel, ceramic and plastic pipe threads, and for joining or connecting dissimilar materials.

### Pressure Sensitive Tape . .

. . . formulated for attachment to metals, wood, rubber, glass, plastics, other rigid materials—*Flexrock Co., Packing Div., Dept. HPAC, 3603 K Filbert St., Philadelphia* 1.

Plastic tape binds on contact pressure. Recommended for industrial applications, covering chutes, slides, rolls, guide rails, measuring and feeding devices, etc. Produced in sizes ½ to 12 in. wide, 0.005 thick, packaged on 100 ft spools. For protection during long periods of storage, strippable paper backing used.



### Hole Saws . . .

. . . intended for heating, piping and air conditioning applications — *Arrow Metal Products Co., Dept. HPAC, 421 W. 203rd St., New York* 34.

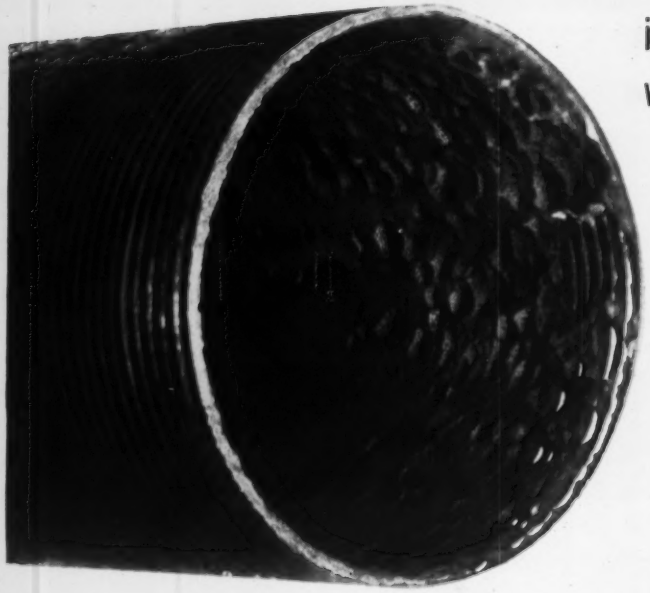
All models of heavy duty "Arco" hole saw are equipped with slug-ejector which pops out slugs and discs automatically. Available in several models with 1 or 2¼ in. long blades. "No. 630" has 5 blades to cut tap size holes for ¾, 1, 1¼, 1½, 2 in. pipe. "No. 640" has 6 blades to cut slip-fit holes for ½, ¾, 1, 1¼, 1½, 2 in. pipe. Blades designed to saw through steel, cast iron, lumber, wallboard, plastics.

### Flexible Ducting . . .

. . . for air conditioning systems—*Flexible Tubing Corp., Dept. HPAC, Guilford, Conn.*

"Thermaflex ST" is continuous, vinyl coated glass fiber cover, fused to vinyl coated spring steel wire helix. Recommended for use with high or low pressure air conditioning systems. Can be installed without special tools. Material is waterproof, airtight, flameproof, says manufacturer. Available in 16 ft lengths, 2 to 10 in. diam.


# control condensate corrosion



An example of pipe after attack by condensate corrosion.

## increase heat transfer—reduce maintenance with HAGAFILM®

Hagafilm, the safe filming amine, forms a non-wettable film on all metal surfaces, including copper and its alloys. Fed to the boiler, to the feedwater, or directly to steam lines in economical quantities (2 to 3 lbs. per 1,000,000 lbs. of steam), Hagafilm forms a thin, tough coating which controls corrosion. Its non-wettable character promotes dropwise condensation which can increase heat transfer.

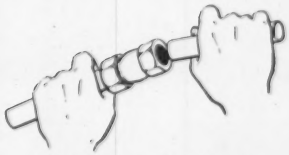
Hagafilm is available in both solid and liquid forms and is safe to handle and use. Hagafilm cleans out old corrosion deposits, reduces maintenance costs and keeps valves, traps and pumps at top efficiency.

Write for free bulletin. Learn how Hagafilm can save money and time in every operation where steam is used.

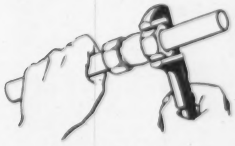
**HAGAN CHEMICALS & CONTROLS, INC.**

HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

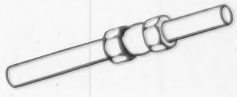
## HOW IT WORKS



**1.** Stab pipe ends into factory assembled Dresser Fitting.



**2.** Tighten end nuts—takes only a few seconds.



**3.** And you're through! A permanently tight, flexible joint.

# There is one simple way of joining pipe

Dresser® Compression Fittings are the simplest, most efficient way of joining pipe. In even the most complex maze of pipe, joining is easy the Dresser way.

No elaborate equipment or preparation required for installation... no skinned knuckles or fumbling in tight quarters. A few turns of a simple hand wrench and you've got a *permanent, leak-proof* joint. The special compound Dresser gasket absorbs vibration, prevents pipe and equipment failure. The one simple, reliable way of joining pipe is the Dresser way.

Dresser's staff of highly qualified engineers may well be able to help you cut costs in the designing stage of your product. It will pay you to talk to them.

SEND FOR BOOKLET 505-R. COMPLETE DETAILS, SPECIFICATIONS, AND IN-USE SITUATIONS.

**DRESSER**
MANUFACTURING DIVISION
ONE OF THE DRESSER INDUSTRIES®

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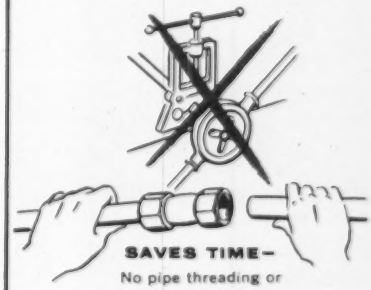
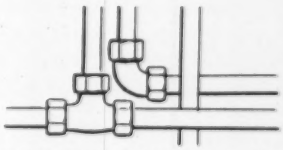
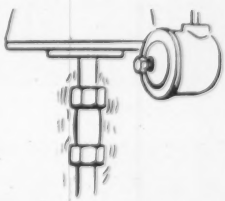
## WHAT IT DOES



**SAVES TIME—**
No pipe threading or exact pipe lengths.



**SIMPLIFIES INSTALLATION—**
Permanent, leak-proof joints even with misaligned pipe (up to 6° deflection at each joint).



**ABSORBS VIBRATION—**
Prevents stresses that often cause pipe and equipment failure.

# DO YOU FIND YOUR PUMP PROBLEM HERE?

**A** Water Supply
Air Conditioning
Refrigeration
Cooling Towers
Sump Pumping, Etc.

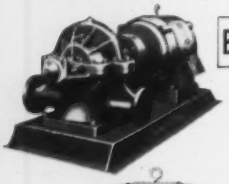
**B** Booster Service
Cooling Towers
Water Treatment
Water Circulation
Brine Service, Etc.

**C** Hot Water Circulation
Ice Water or Brine
Clear Water
Boilers
Booster Service, Etc.

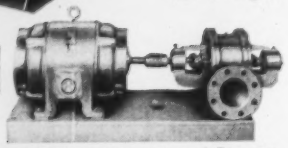
**D** Hot and Cold Liquids
Refrigerants
Boiler Feed
Cooling Towers

# Then You'll Find Your Best Answer Here—

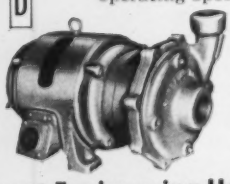
**A** **F-M Pomona Water-Lubricated Turbine Pumps**
Easily installed, easy to adjust for varying field conditions. Available with wide choice of drivers.



**B** **F-M Split-Case Centrifugal Pumps**
Capacities, pressures and sizes for any requirements. Single-stage or multistage.



**C** **F-M Westco Peripheral Pumps**
Capacities to 200 gpm. Pressures to 900 ft. Sizes 1½" through 2½". Horizontal single-stage or multistage. Develops high pressure at normal operating speeds.



**D** **F-M Builtogether Centrifugal Pumps**
Capacities to 900 gpm. Pressures to 525 ft. Sizes ¾" through 5". Single-stage or multistage.

## *FREE!* Expert Engineering Help at Your Service

Be *sure* of low-cost, foolproof pumping installations that match your exact requirements... call in your Fairbanks-Morse Sales Engineer. Take advantage of his broad technical background and expert knowledge of pumps for air conditioning, plumbing and heating. Call him today, or write Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Illinois.

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*a name worth remembering when you want the BEST*

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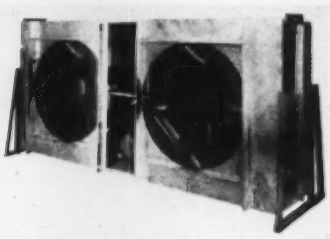
## EQUIPMENT DEVELOPMENTS

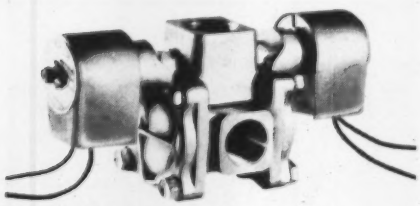
*Continued*



### Air Cooled Condensers . . .

. . . intended for use in large applications where water is not accessible—*Recold Corp., Dept. HPAC, 7250 E. Slauson Ave., Los Angeles* 22.

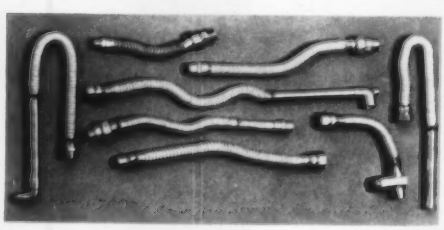
"DC-30" and "DC-40," rated at 30 and 40 tons respectively, can be grouped in multiples for exceptionally big installations. Features cited: balanced circuiting; adjustable angle iron stand; large, slow-speed, belt-driven fans; galvanized housing; copper tube aluminum fin coils; strong fan guard; precision ground shaft; self-aligning ball bearings; motor located inside unit.



### Solenoid Valve . . .

. . . designed to control hot and cold water to industrial or commercial laundry machines—*Automatic Switch Co., Dept. HPAC, Florham Park, N. J.*

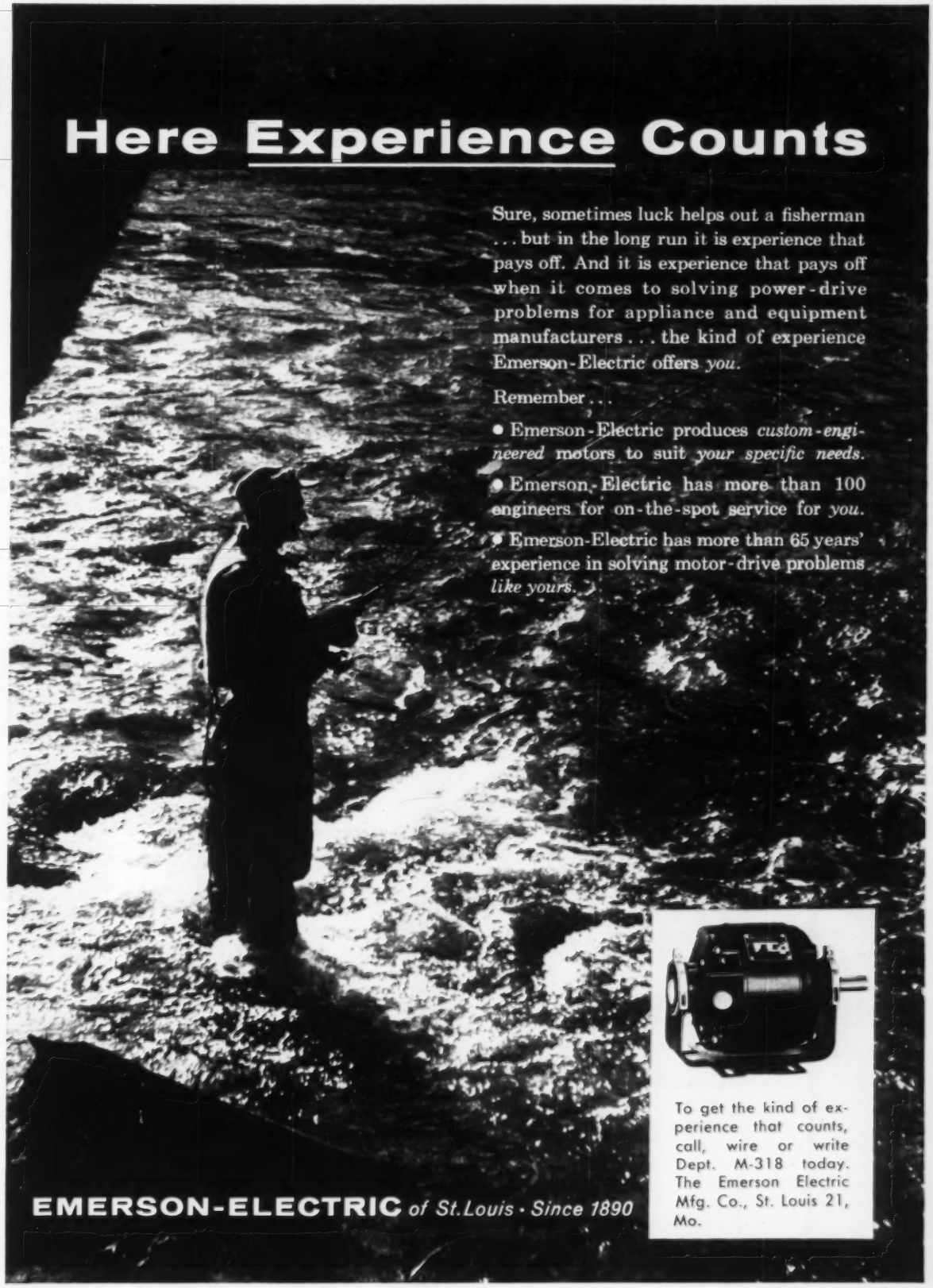
Inlet valve has heavy forged brass body and bonnet, two ¾ in. inlet connections and a common 1 in. outlet connection. Operation is normally closed (valve closes when solenoid is de-energized). Dual solenoids may be energized together or separately, as required. Pressure range is 5 to 125 psi. Valves operate on either a-c (10.5 watts) or d-c (10 watts), available at standard voltages.



### Flexible Hose . . .

. . . for hot water and steam heating systems—*Cobra Metal Hose, Dept. HPAC, 5059 S. Kedzie Ave., Chicago 32, Ill.*

# Here Experience Counts



Sure, sometimes luck helps out a fisherman . . . but in the long run it is experience that pays off. And it is experience that pays off when it comes to solving power-drive problems for appliance and equipment manufacturers . . . the kind of experience Emerson-Electric offers *you*.

Remember . . .

- Emerson-Electric produces *custom-engineered* motors to suit *your specific needs*.
- Emerson-Electric has more than 100 engineers for on-the-spot service for *you*.
- Emerson-Electric has more than 65 years' experience in solving motor-drive problems *like yours*.



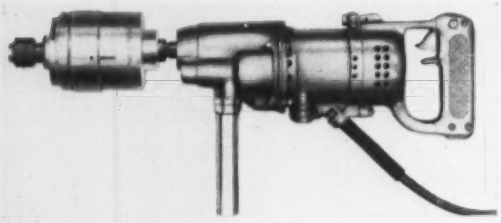
To get the kind of experience that counts, call, wire or write Dept. M-318 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.

**EMERSON-ELECTRIC** *of St. Louis · Since 1890*

## EQUIPMENT DEVELOPMENTS

*Continued*

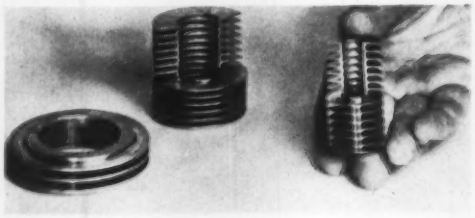
Line of flexible metal wet heat connectors ½, ¾ in. diam supplemented by 14 models in 30 combinations. Being completely flexible, connectors eliminate many fittings, nipples, assembly operations, according to manufacturer. Connectors are sound absorbent, take up expansion, contraction of lines. Constructed of bronze metal tubing, can be used with temperatures to 350 F. Recommended working pressure for ½ in. diam is 55 psi, for ¾ in. diam is 40 psi.



### Tube Expanders . . .

. . . for controlled tube rolling—*Gustav Wiedeke Co., Dept. HPAC,* 1833 *Richard St., Dayton* 1, *Ohio.*

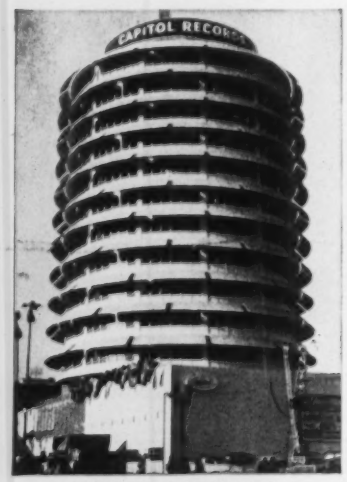
"Expand-o-trol" measures tightness of expanded tube joints by utilizing torque resistance of expanding tube, resulting in uniformly rolled tube joints within tube bundle, according to manufacturer. Incorporates slip clutch with friction wear compensating feature; when desired torque is reached, metallic-embedded fiber disc slips against mating steel hub, discontinuing further expansion. Measures torque applied to tube expander; will roll tube to 0.001 in. Develops up to 25 ft-lb torque, may be used to roll larger diam light wall tubes. Recommended by manufacturer for use with its "No. 255" and "No. 270" ball bearing thrust collar type tube expanders.



### Finned Tubing . . .

. . . for application in gas cooled nuclear power plants —*Wolverine Tube Div. of Calumet & Hecla, Inc., Dept. HPAC,* 17200 *Southfield Rd., Allen Park, Mich.*

Integrally finned tubing in low carbon steel, "Magnox" (magnesium-beryllium alloy). Fin heights: steel, 3/16 to ½ in.; magnesium alloy, 3/16 to ⅝ in. Fins per in.: steel, 5, 7; magnesium alloy, 5, 7, 9. Tube wall thickness: steel, 1/16 to ¼ in.; magnesium alloy, 0.040 to 0.25 in. Integrally finned tubing produced under license in Great Britain for use with British gas cooled nuclear power plants. ‡


CAPITOL RECORDS BLDG.
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WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

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VISIT OUR BOOTH 624
AT THE INTERNATIONAL EXPOSITION

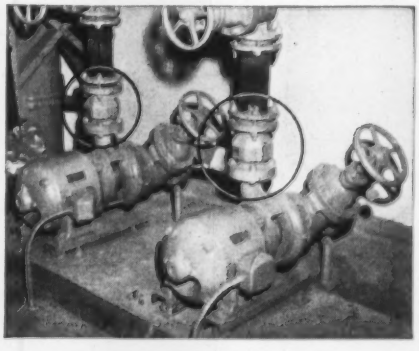
**MILLER Streamflow CHECK VALVES**

**Completely** Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW. FACTORY MUTUAL LABORATORIES APPROVED.

SIZES 1" THROUGH 24".

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS. FOR ALL FLUIDS AND GASES.

CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE



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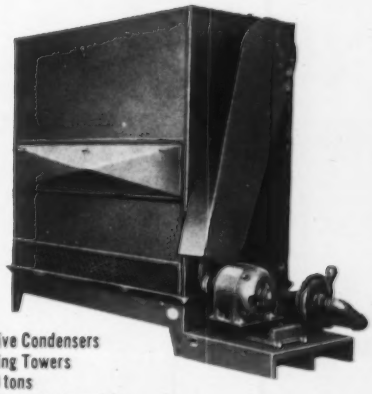
**MILLER VALVE CO., INC.**

Plant—1620 Pennsylvania Ave.

# You can count on HIGHER PROFITS WITH Curtis AIR CONDITIONERS



Evaporative Condensers
and Cooling Towers
up to 100 tons
Air handling units to match.

Packaged Liquid Chillers—
7½ to 100 tons—F-12 or F-22.
With room console units to provide
controlled cooling and heating
without duct work.

## *HERE'S WHY...*

### MAXIMUM DEPENDABILITY

Each CURTIS unit is backed by 104 years of engineering and manufacturing experience . . . one of many reasons why CURTIS air conditioning equipment operates at maximum efficiency with a minimum of maintenance.

### CUSTOMER SATISFACTION

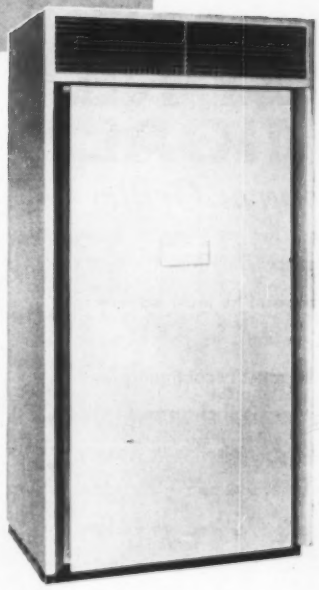
The long operational life and minimum service requirements of CURTIS air conditioning, combined with peak performance, assures satisfied customers.

### PRE-SOLD PROSPECTS

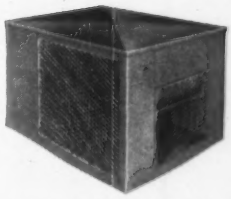
National advertising beamed at virtually every prospect category helps *pre-sell* Curtis equipment for you. CURTIS provides sales and promotional aids to make your selling job *easier*.

### PRICED FOR PROFITS

All Curtis air conditioning equipment is *competitively* priced, with a very generous profit margin *for you!*



Packaged
air conditioning
units—
3 through
50 tons.



Packaged Air Cooled Air
Conditioning Units—2
through 7½ tons. Residential
and commercial applications.

Condensing units up to
100 tons—F-12 or F-22.

REMEMBER—
you can count on Curtis

OUR 104th YEAR

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Represented in Canada by — T. M. Hall Ltd., 30 Milner St., Montreal West 28, P.Q., Canada

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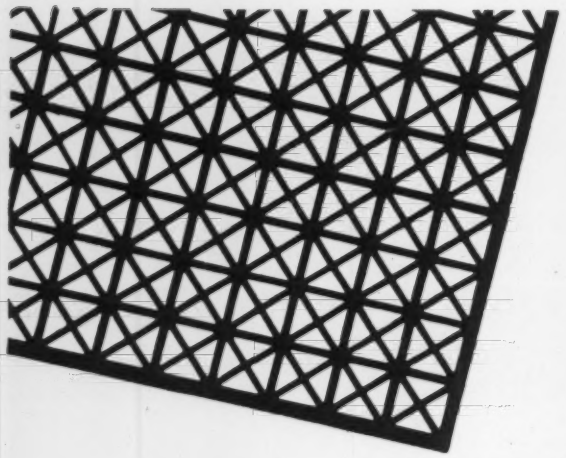

# THEY'RE ELEGANT ...THEY'RE ECONOMICAL

*Hendrick Architectural Grilles*

When an architect draws up specifications for a new building or a modernization proposal he must adhere to two basic principles: FIRST, he must use his head in keeping costs down. SECOND, he must recommend functional materials and components that appeal to his client's decorative motif and sense of beauty. That's why more and more architects specify Hendrick Grilles. Available in hundreds of attractive designs, Hendrick Grilles cost less to buy . . . cost less to install and cost less to maintain! And they provide more-than-ample area for free passage of air . . . always lie flat . . . don't bend or warp. For more information write to Hendrick, today.

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**Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Hendrick Wedge Wire Screens • Architectural Grilles Mitco Open Steel Flooring — Shur-Site Treads • Armorgrids Hydro Dehazers • Petrochemical Column Internals**

#625

## RECENT TRADE LITERATURE...

▸ *AIR DIFFUSERS*—Full details on company's line of "Series TMD" square and rectangular air diffusers given in 20 page catalog. Diffusers available in variety of styles, sizes. Comprehensive engineering section in publication intended to make selection of diffusers for required application faster, easier. Catalog illustrated with photos, line drawings, charts. Specifications for models given with dimensions in tables. *Titus Mfg. Co., Dept. HPAC, Box* 810, *Hiway* 20, *Waterloo, Iowa.*

▸ *AIR HYGIENE FOR HOSPITALS*—New 14 page bulletin deals with cases and tests, results, facts concerning air conditioning procedures in hospitals. Recommendations made in publication for standards of sterility, specifications for hospital operating room air conditioner, insulation, grilles, registers, air control devices, etc. *Air Conditioning and Drying Div., Surface Combustion Corp., Dept. HPAC,* 2375 *Dorr St., Toledo* 1.

▸ *AIR HYGIENE FOR PROCESSING PLANTS*—Bulletin gives 5 page account of tests with manufacturer's "Kathabar" air purification equipment in processing plant environments. Advantages, features of equipment cited. Efficiency of unit shown in graph of test results. *Air Conditioning and Drying Div., Surface Combustion Corp., Dept. HPAC,* 2375 *Dorr St., Toledo* 1.

▸ *BOILERS*—Features, advantages, data, dimensions, recommended boiler room layout for company's "Compact" boilers given in 12 page brochure. Text explains conception, production of boilers. Boilers have four-pass design, 5 sq ft of heating surface per bhp with induced draft. Boilers insulated, jacketed, factory assembled, fire-tested. Built in sizes 20 to 200 bhp, for pressures to 250 psi. Fully automatic operation, firing oil, gas or both. Features cited: hinged front, rear doors; downdraft design; constant gas pilot for gas firing; viscosity control; integrated steam-electric oil heaters. *Superior Combustion Industries, Inc., Dept. HPAC,* 1475 *Broadway, New York* 36.

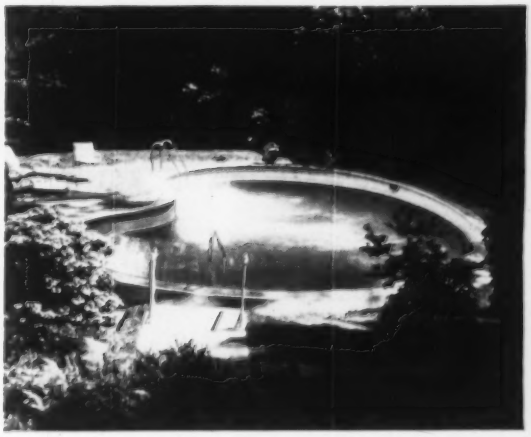
▸ *CENTRIFUGAL FANS*—Two illustrated bulletins, "8414," "8314" describe line of centrifugal fan utility sets. Bulletin "8414" covers company's "HS" series, giving complete dimensions, specifications for each model. "Sirocco" series presented in bulletin "8314." Complete variety of sizes, styles—direct drive and v-belt drive outlined in text, pictures, charts, diagrams. *American Blower Div. of American-Standard, Dept. HPAC, Detroit* 32.

# LOW COST STEEL PIPE HELPS PUT SWIMMING INTO YOUR BACK YARD!

Home swimming pools, once an unaffordable luxury for most families, are now available at prices within the reach of many, thanks to new, cheaper construction methods and inexpensive materials such as *steel pipe*.

In the 30,000 back yard pools that will be installed this year, reliable *steel pipe* will be used variously for supply and drainage lines, ladders, filtration systems, diving board supports . . . yes, even to radiantly heat the water if desired!

*Steel pipe* because it is the least expensive and most versatile of metal tubular products, contributes to the economic availability of so many good things in life. Yes, *steel pipe* is the most widely used pipe in the world for radiant heating, snow melting, fire sprinkler systems, vent and drainage lines, electrical conduit, structural uses, refrigeration, gas, oil and water lines.



Pools like this and the one above are within the financial reach of many 2-car families and low-cost *steel pipe* helps to make this true.

### STEEL PIPE IS FIRST CHOICE

- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

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LARGE OR SMALL

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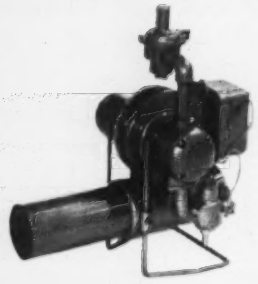
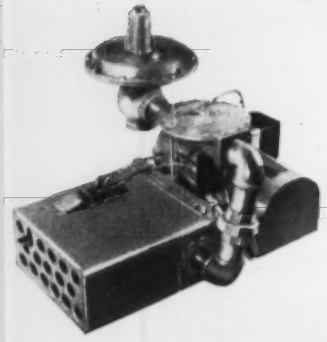
POWER GAS BURNERS

# SAVE MONEY

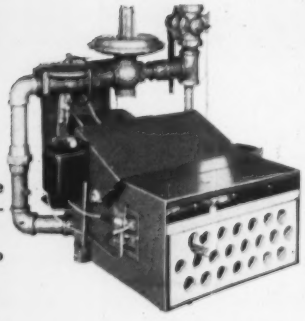
**THE ECONOMITE**
**FOR RESIDENTIAL INSTALLATIONS**
Capacities from 75,000 to 700,000 BTU/hr. input.





**THE STANDARD Lo-BLAST**
Capacities from 100,000 to 20,000,000 BTU/hr. input.

**THE DUAL FUEL Lo-BLAST**
The finest gas burner...the finest oil burner now combined in one great unit.
Capacities from 600,000 to 2,500,000 BTU/hr. input.



**AVERAGE 10% LESS IN OPERATING COST**

Lo-BLAST Power Gas Burners save money because they eliminate the fuel waste caused by uncontrolled draft.

When a *power type* burner shuts off, there is no rush of draft air to carry heat up the chimney, a condition which would cause a serious fuel waste. The Lo-BLAST Burner does not depend upon natural draft, but upon air supplied by a small *quiet* blower. It provides combustion air *only when the burner is on!* When the burner shuts off, the flow of air shuts off. The heating plant thus retains much of its heat between operations.

That's why Lo-BLAST Burners cost substantially less to operate.

**SEND TODAY FOR COMPLETE INFORMATION**

**MID-CONTINENT METAL PRODUCTS CO.**
1960 N. Clybourn Ave., Chicago 14, Ill.


## RECENT TRADE LITERATURE

*Continued*

▸ *CONTROLS*—Recently released catalog details mechanical cooling, air conditioning controls. New listings include: "Series 246" all-range water valves; "Series 3246" 3-way water valves for cooling tower applications; "Series 872X" line voltage heating-cooling thermostats; freeze protection control designed to prevent freeze-ups in meat cases, milk coolers, etc. *Penn Controls, Inc., Dept. HPAC, Goshen, Ind.*

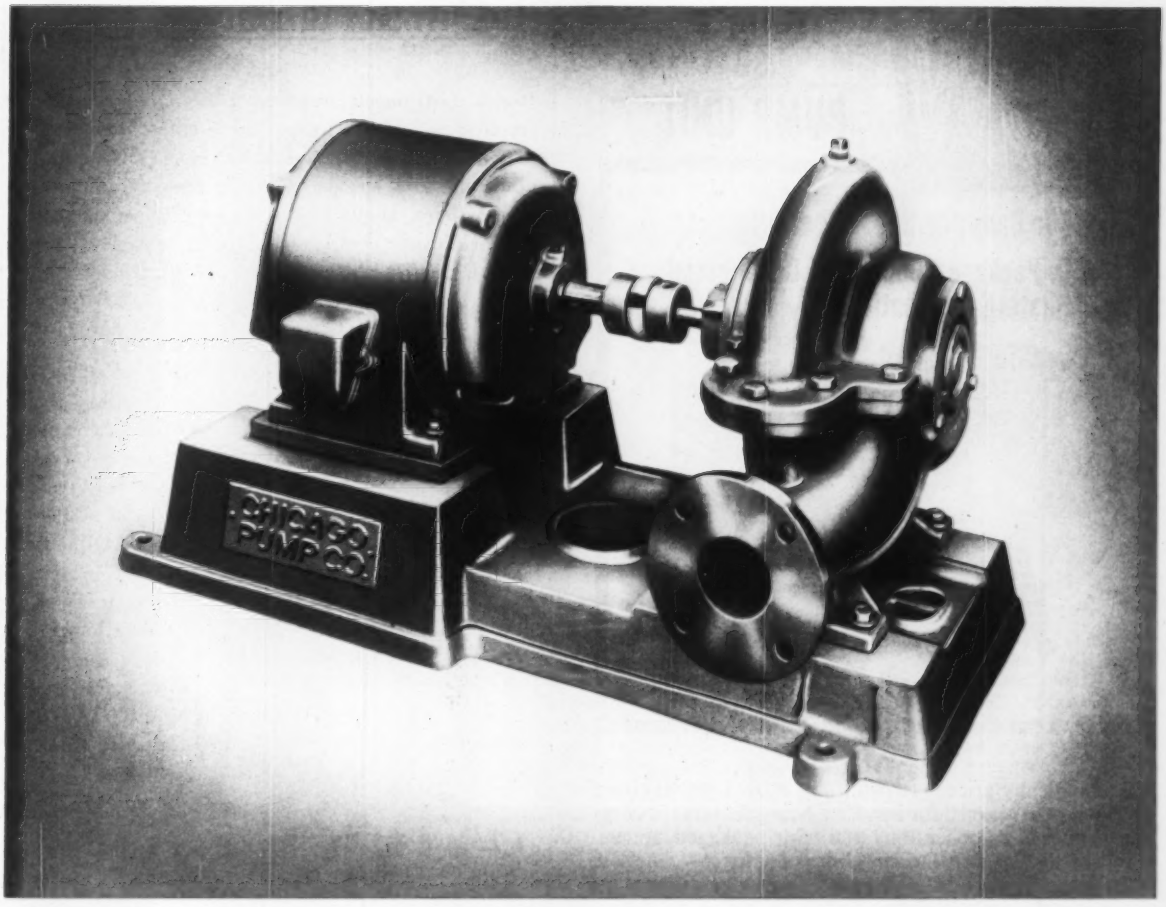
▸ *COOLING TOWER*—Circular "SP-1" gives details on "Hydra-Glide" line of induced draft, packaged water cooling towers for use with commercial, industrial air conditioning systems. Features cited: use of slip-fit type joints; one grease point; no-warp, nailless filling. Available in capacities 8 to 75 tons. Circular is illustrated with photos, line drawings. Charts give specifications, dimensions, performance ratings. *Mason Products, Inc., Section 3, Dept. HPAC, 317 Main St., West Concord, Mass.*

▸ *DRYERS, HEATERS*—Illustrated 8 page booklet covers company's ovens, dryers, heaters used in pulp, paper mill ventilating, heating and cooling, other processes requiring engineered air systems. Booklet illustrates applications of equipment. Information included on indirect oil or gas fired heaters, shell type direct air heater, tubular type indirect air heater, "Ross Supertherm" high pressure hot water heating system. *J. O. Ross Engineering Div. of Midland-Ross Corp., Dept. HPAC, 444 Madison Ave., New York.*

▸ *DUCT SILENCERS*—Line of "Quiet-Duct" silencers for air conditioning and ventilating systems presented in catalog. Applications, methods of selecting correct sized silencers for noise control covered in booklet. *Industrial Acoustics Co., Dept. HPAC, 341 Jackson Ave., New York* 54.

▸ *ELECTRIC BLAST COIL HEATERS*—Two new bulletins cover installation of units. "E97U" describes product, giving specifications, dimensions with specific instructions for installation in ducts. Bulletin "E97P" describes heaters, gives instructions for installation in package air conditioners. Necessary dimensional data, specifications of leading package air conditioners given. Both bulletins are illustrated with photos, diagrams. *Industrial Engineering and Equipment Co., Dept. HPAC, Hanley Industrial Ct., St. Louis (Brentwood)* 17.

▸ *ENVIRONMENTAL TEST INSTRUMENTATION*—Recently released bulletin "W1831" outlines company's indicating, recording, programming, controlling instruments for environmental test equip-




"from Chicago"

# A NEW LINE OF HORIZONTALLY SPLIT-CASE CENTRIFUGAL PUMPS

*Quiet Operating . . . Low Cost . . . Efficient, Hydraulically Balanced*

**FOR**

**AIR CONDITIONING**
Air Washing
Chilled Water Circulating
Condenser Water Service
Cooling Tower Circulating

**BOOSTER**
Increasing City Water Pressure

**HEATING**
Boiler Feed
Condensation
Hot Water Circulating

**PNEUMATIC WATER SYSTEMS**
Automatically maintaining the required pressure in closed tanks to instantaneously deliver water to all fixtures.

**REFRIGERATION**
Water Circulating

**SNOW MELTING**
Ethelene Glycol Circulating

Chicago Pump Company announces a new line of Single Stage, Horizontally Split-Case Centrifugal Pumps—known as Type "S".

These pumps feature heavy shafts . . . short span between bearings . . . minimum space requirements . . . excellent operating efficiencies . . . desirable capacity-head characteristics . . . pre-lubricated ball bearings . . . mechanical seals . . . easily removable rotating assembly . . . suction and discharge on same lower casing centerline . . . rugged construction throughout to insure years of trouble-free service.

Bulletins and engineering data are available to Architects and Engineers from Chicago Pump Company or its Distributors located in most principal cities.

fmc
FOOD MACHINERY AND CHEMICAL CORPORATION

*Putting Ideas to Work*

FOOD MACHINERY AND CHEMICAL CORPORATION

**Chicago Pump Company**

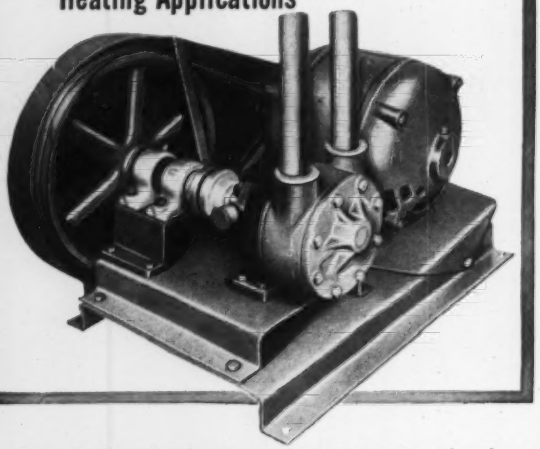
622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Copyright 1958—Chicago Pump Company

new

TUTHILL
SU
PUMP UNIT

- For Handling Heavy Fuel Oils
- In Packaged Boiler and Commercial Heating Applications

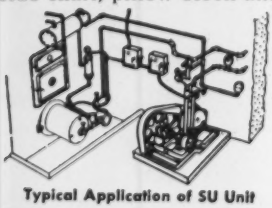


Economically priced, TUTHILL'S SU PUMP UNIT has been specifically developed for handling heavy fuel oils in commercial heating applications and with packaged boilers.

This "v" Belt Driven Unit is compact—complete units measure only 24¼" x 14⅜". Quiet operation is insured by the 2 or 4 "v" Belt Drive and the integral gear positive displacement pump design.

Construction features which provide dependable trouble-free operation, lower maintenance costs, include two ball bearing pillow blocks, one point take-up for simple adjustment of belt tension, removable belt guard and new fabricated steel base with versatile motor mounting.

SU PUMP UNITS can be furnished with a wide variety of pumps and motors for pressures up to 300 psi, capacities to 2030 gallons per hour. Sub-assemblies of pump, stub shaft, pillow block and sub-base are also furnished separately as a unit for incorporation into systems by boiler and furnace manufacturers. Write today for complete information.



Typical Application of SU Unit

TUTHILL PUMP COMPANY
947 East 95th Street, Chicago 19, Illinois
Gentlemen:
Please forward Catalog describing Tuthill SU Pump Units.
NAME_____ COMPANY_____
TITLE_____
STREET_____
CITY_____ STATE_____

TUTHILL PUMP COMPANY
947 East 95th Street, Chicago 19, Ill.
PUMPS FOR YOUR PURPOSE


## RECENT TRADE LITERATURE *Continued*

ment. Instruments measure, record and control humidity, altitude, pressure, flow, other variables. Offered in range of models for range of conditions. Bulletin gives specifications for temperature measuring systems, absolute pressure gages, pneumatic, electric, electronic controllers, program controllers. *Bristol Co., Dept. HPAC, P. O. Box* 1790, *Waterbury* 20.

▶ *FLANGES, WELDING FITTINGS*—Catalog describes company's line of flanges, gaskets, seamless welding fittings. Includes history, outline of company's operation, detailed information on testing methods, specifications on "Blue Ribbon" products. Five sections of catalog given over to flanges; 150 to 2900 lb forged steel flanges, described, illustrated. Ring joint gaskets occupy one section; gaskets are in sizes 1 11/32 to 24½ in. Section devoted to seamless welding fittings includes listings of 90 deg ells in long, short radius, 45 deg ells, 180 ells, 180 deg ells in long, short radius, tees in full branch and reducing styles, welding caps, saddles. Sizes ½ through 24 in. *OTM, Dept. HPAC, P. O. Box* 19296, *Houston, Tex.*

▶ *FLEXIBLE METAL HOSE*—Illustrated 36 page booklet devoted to company's line of "Penflex" flexible metal hose in variety of materials, sizes, connections for wide range of applications. Background of product described with its development, production, recommended applications. Complete specifications given in chart form with illustrations of each type, diagrams of construction. *Pennsylvania Flexible Metallic Tubing Co., Inc., Dept. HPAC,* 7200 *Powers Lane, Philadelphia.*

▶ *FLOAT VALVE*—Catalog sheet describes company's auxiliary actuated types "214," "216" float valves which permit control of liquid levels within 1 in. limits in open or closed vessels. Single seat design, piston operated valves provide tight closure for dead end applications, according to manufacturer. Operation from minimum inlet pressure of 15 psi to maximum of 150 psi. Valve features, method of operation, ordering and installation information, parts list, diagrams included in catalog sheet. *Atlas Valve Co., Dept. HPAC,* 280 *South St., Newark* 5, *N. J.*

▶ *FLOW METER*—Specification "S292-2" describes in detail construction, operation of manufacturer's bellows meter for flow, liquid level applications. Included are features, specifications, options, illustrations. Cat-

**FIRST in Airfoil Bladed Fans**

**50% more used than any other make**

# "Chicago" Airfoil Fans solve 3 tough problems in Koppers Building

Consulting engineers, Peter F. Loftus Corporation, were faced with three limitations in planning the year 'round air conditioning system for this 28-year-old building:

1. Fans had to run extremely quietly because of adjacent offices.
2. Fan equipment rooms had to be small to conserve rental space.
3. No alterations on the exterior of the building were permitted.

"Chicago" Airfoil Centrifugal Fans met these specifications perfectly. Their efficiency (92%) enabled the consulting engineer to move the required volume of air with much smaller fans and motors. This not only saved valuable floor space, but also saved horsepower. Their quiet operation (65% less noise) prevented tenant complaints.

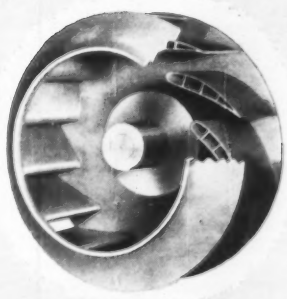
Engineers have recognized the superiority of "Chicago" Airfoil Bladed Fans since they were first introduced in 1951 and have specified them for . . .

General and heavy duty applications in . . .

- Air supply and exhaust
- Mechanical draft
- Industrial processing
- Building and tunnel ventilation
- High pressure and conventional ventilation

**28-Year-Old Koppers Building Pittsburgh, Pa.**

Air conditioning this 33-story building was the largest installation ever attempted in the Pittsburgh area.



**65% less noise, 35% less horsepower, 92% efficiency with "Chicago" Airfoil aerodynamic wheel design**

First major advancement in 40 years obsoletes conventional flat bladed designs.

Air passes over the all-welded airfoil shaped blades with less turbulence, greatly reducing air "roar" and current consumption.

*Fans available in all capacities, classes and pressures.*

***Clip coupon and mail for catalog and data on Koppers Building!***

Find Your Nearest Agent in the YELLOW PAGES

**CHICAGO BLOWER CORPORATION**

**CHICAGO BLOWER CORPORATION**
**9869 Pacific Ave., Franklin Park, Ill.**

☐ Send free 64-page Airfoil Centrifugal Catalog A-103
☐ Send detailed data on Koppers Building installation

Name_____

Firm_____

Address_____

City_____ Zone____ State_____

8027

## RECENT TRADE LITERATURE

*Continued*

alog "C22-1" covers features, applications of meter. Two basic models described: one for flow and liquid level in open tanks; the other for liquid level in closed tanks under pressure or vacuum. *Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia* 44.

▸ *GEAR COUPLING*—New, 4 page bulletin covers major products of manufacturer. Included are "Standard" gear coupling, "Francke Flexible 162 M" nylon gear coupling, said to require no lubrication, "Junior," "Anchor Waldron Cut-Out" coupling, "Smith & Serrell Flexpin and Flexring." *John Waldron Corp., Dept. HPAC, P. O. Box* 791, *New Brunswick, N. J.*

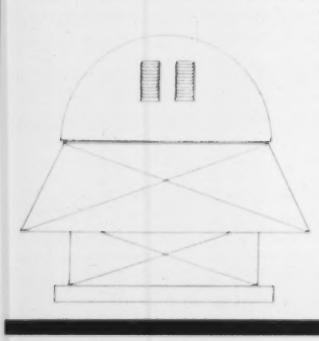
▸ *GRILLES, DIFFUSERS*—Catalog presents line of aluminum "Precisionaire" grilles, diffusers. Side wall grilles, ceiling grilles, return grilles types covered in illustrations, dimension and specification tables. Engineering data for all models also included. No rust, light weight, smart design cited by manufacturer as features of line. *D. F. Bowman Co., Inc., Dept. HPAC, P. O. Box* 449, *Clearwater, Fla.*

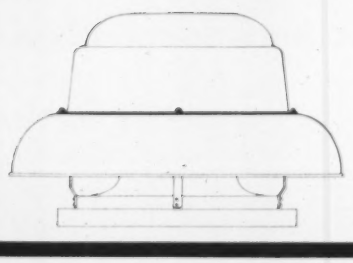
▸ *HEATERS, TANKS*—Descriptive 21 page publication outlines history, operation of company in text, illustrations. "This Is Reco" serves a complete introduction to company and its operation. Production capacity, plant equipment presented in one section. Field fabrication installations outlined in another. Most of booklet devoted to presentation of company's line of pressure vessels, storage tanks, stacks, pipes, ducts, flumes, process heat exchangers, towers, columns, autoclaves. *Richmond Engineering Co., Dept. HPAC, Seventh and Hospital Sts., Richmond, Va.*

▸ *HEATING AND VENTILATING UNITS*—Information on redesigned line of manufacturer's heating and ventilating units is given in 48 page, illustrated catalog "Bulletin 8927." Bulletin describes types, sizes of units available. Separate sections in bulletin devoted to major components such as coils, fan section and accessories; details of construction given. Tables on steam heating capacities, hot water heating capacities, fan capacities, air friction all included. Installation drawings, dimensional information given. Block diagram drawings show combinations possible in fan rotation and discharge, coil arrangements, mounting arrangements. *American Blower, Div. of American-Standard, Dept. HPAC, Detroit* 32.

▸ *HIGH PRESSURE PUMPS*—Recently issued bulletin "1070" describes, illustrates group of pumps available for pressure fluid handling. Pumps used in high pressure test loop work, radioactive fluid handling, other applications requiring zero leakage pumping in pressurized systems. Capacities to 350 gpm,


new LC* dynafans by PENN





Penn's new Low Contour Dynafans now offer unlimited possibilities for architectural building designs where streamlined silhouettes are desired.

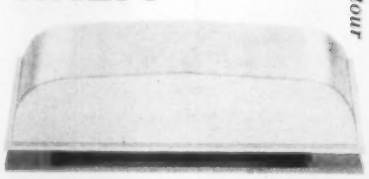
Reduced in height to almost one-half the size of conventional exhausters, this versatile unit contains all of the important features found in Penn's standard model LVQ (Low Velocity Wheel Design) units plus many improvements for lengthening unit life due to new straddled bearing design.

Complete performance data and technical information can be had by writing for Dynafan Bulletin PD-42LC or contacting the Penn Ventilator man in your area.

REDUCE ROOF EXHAUSTER HEIGHTS

ALMOST ONE HALF!

*low contour



PENN VENTILATOR CO., Inc.
Philadelphia 40, Pa.

Representatives and distributors in principal cities
Charter member of AMCA

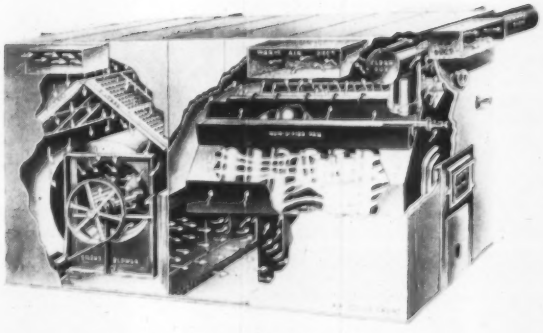
Campbell

# WARM AIR HEATERS FOR LARGE BUILDINGS

Towner County Memorial Armory, Cando, North Dakota. Comfortably heated with a single No. 8175 Campbell oil-fired heater. Architect, James V. DeLoi, Minot, N.D. Heating contractor, Miller Sheet Metal Co., Minot, N.D.

## FAMED FOR PERFORMANCE

You can be sure of outstanding performance at low cost, even in the coldest climate, when you specify Campbell Warm Air Heaters. Fast heat delivery, positive control of temperature, humidity and ventilation—PLUS—low first cost, low installation cost, and low operating cost, all add up to customer satisfaction. Campbell Heaters are available for all fuels in capacities up to 3,150,000 BTUs. Your inquiry will receive prompt attention.



**MANUFACTURERS' AGENTS**

**We have some very attractive openings for men calling on heating contractors and architects.**

**CAMPBELL HEATING COMPANY**

**DES MOINES 17, IOWA**

**This simplicity benefits all three: Engineer, Owner and Contractor!**

**So install an**

# AMERICAN-MARSH

## *Redi-Return* Condensation Unit

**CHECK THE CUTAWAY** view above. See for yourself the simplicity and quality of the *Redi-Return*. You'll find this Condensation Unit better-built throughout.

**EASY TO SPECIFY** — The Engineer can select the most suitable unit from a full range of sizes with vertical or horizontal pumps, single or twin motor-pump units.

**EASY TO INSTALL** — The Contractor needs only to bolt unit in place, connect return line to inlet and discharge pipe to pump outlet and make electrical connections.

**EASY TO MAINTAIN** — The Owner will enjoy long-lived, trouble-free operation. *The design eliminates suction troubles* because impeller operates submerged in condensate. Pump itself needs no lubrication. Compare it with any make — and you'll see how *Redi-Return* simplicity benefits you!

**NUMEROUS TYPES, SIZES**

Redi-Return Type CV

Redi-Return Type CHF

**Call your A-M Representative today . . . or WRITE FOR BULLETIN 426.**

**AMERICAN-MARSH PUMPS**

**BATTLE CREEK MICHIGAN**

*Pumps and Pumps only Since 1873*

**Representatives in all principal cities. See our ads in C.E.C., ASME Catalogs**

**CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, ETC.**


## RECENT TRADE LITERATURE

*Continued*

heads to 250 ft available. Line pressures to 3000 psi and higher can be handled by pumps, says manufacturer. *Chempump Corp., Dept. HPAC, 1300 E. Mermaid Lane, Philadelphia* 18.

▸ *MANOMETERS*—Catalog "206" gives information on company's line of manometers for direct pressure indication. Separate models are described in detail, illustrated with photographs. General specifications, individual specifications given. *Dynametrics Corp., Dept. HPAC, Northwest Industrial Park, Burlington, Mass.*

▸ *MANUAL ARC WELDING*—New 24 page booklet, "Reducing Costs By Proper Care of Arc-Welding Circuits," is written in nontechnical language, points out things that can be done to keep electric arc welding circuits operating properly. *Lenco, Inc., Dept. HPAC, 350 W. Adams St., Jackson, Mo.*

▸ *PLUG VALVE*—Bulletin outlines advantages, features of company's "Tru-Flow Dia-Plug" valve, available in sizes 3/8 to 8 in. Bodies of cast iron, cast iron glass line, cast iron lined with rubber, steel, stainless steel, plastic, bronze; diaphragms of rubber, plastic may be obtained. Plug valve intended for use with compressed air, gas, vacuum, water, chemical, oil, slurries, many other applications listed in bulletin. Illustrated and diagrammed. *Dia-Plug Valve Corp., Dept. HPAC, 1622 Fillmore Ave., Buffalo* 11, *N. Y.*

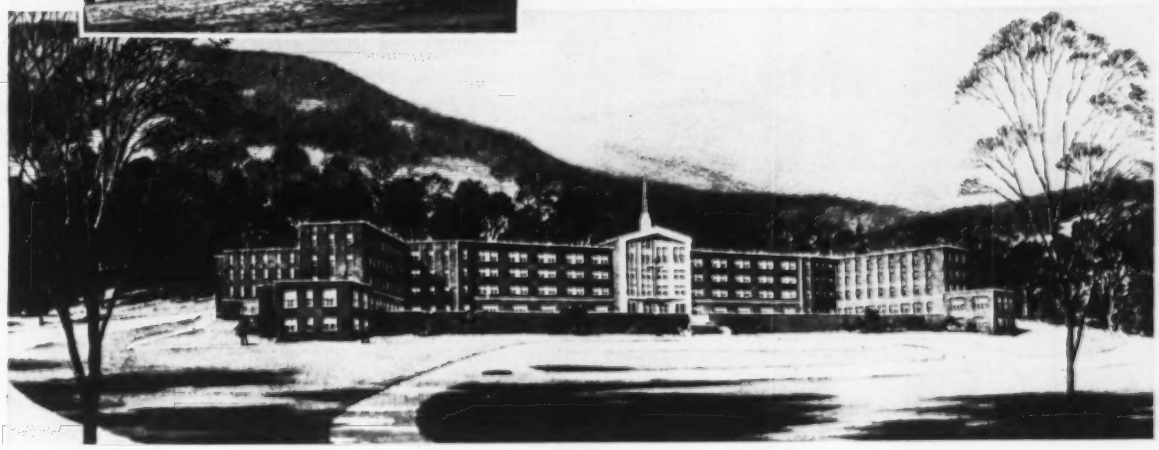
▸ *PNEUMATIC, STEAM, HEATING SPECIALTIES*—Collected catalog describes company's line of products in three sections devoted to pneumatic specialties, steam specialties, heating and plumbing specialties. Each section profusely illustrated, diagrammed with specification charts, texts describing individual items. *Watts Regulator Co., Dept. HPAC, 10 Embankment Rd., Lawrence, Mass.*

▸ *PREFABRICATED TUBING*—Brochure features examples of how company's "Roll-Bond" process is said to reduce retooling time, costs by allowing pattern designer to shape pattern of tubing within single homogeneous sheet of metal. Information on applications, dimensions, specifications given. Illustrated with photographs and drawings. *Olin Mathieson Chemical Corp., Dept. HPAC, 460 Park Ave., New York* 22.

▸ *PRESSURE GAGES*—Illustrated, 48 page catalog introduces new line of gages with ranges 15 psi or 30 in. of vacuum to 20,000 psi. Catalog gives engineering data, selection tables for applications in processing

An early-morning fire in 1956 turned the original Shadowbrook into a roaring inferno, destroying it completely.

(Below) Shadowbrook Novitiate as it will appear at completion.
*Architect:* J. Gerald Phelan, Bridgeport, Conn.
*Consulting Engineers:* Fletcher Thompson Inc., Bridgeport, Conn.
*General Contractor:* Walsh Bros., Inc., Cambridge, Mass.
*Plumbing Contractor:* Crane Plumbing & Heating Co., Cambridge, Mass.
*Plumbing Jobber:* Warner Supply Co., Inc., Westfield, Mass.



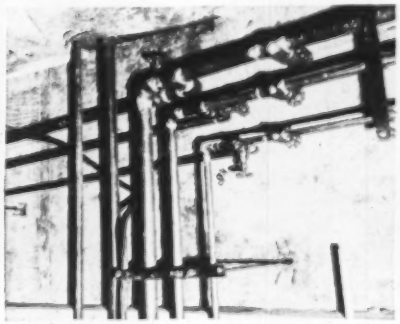
# New Jesuit Seminary Rebuilds for Permanence with Bridgeport Copper Water Tube

Rising out of the ashes of a disastrous fire several years ago is one of the largest structures in Massachusetts' beautiful Berkshire Mountains – the St. Stanislaus Jesuit education center. Called "Shadowbrook," the building stretches along a hilltop for some 500 feet and embodies modern, functional design and the finest of construction materials inside and out.

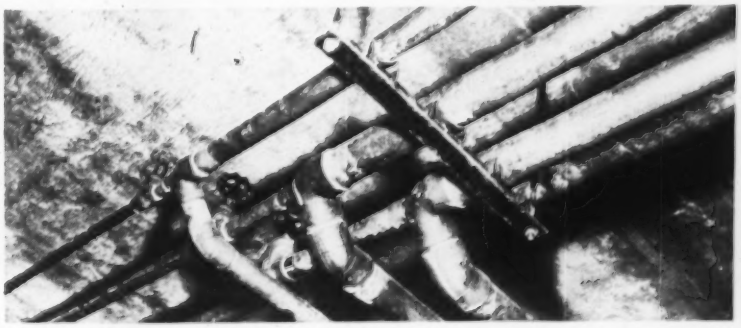
Permanence and quality are the keynotes of the reconstruction. For this reason, Bridgeport Copper Water Tube has been selected for Shadowbrook's extensive water system; 18,800 feet of this high-quality tube, in various sizes, will go into the completed structure.

In this and every installation of Bridgeport Copper Water and Drainage Tube, a number of benefits are enjoyed... long, trouble-free service, lower installation costs, ease of handling and fitting and the secure knowledge that once installed, Bridgeport Copper Tube is in to *stay*.

These are important advantages you can't afford to overlook. Your plumbing wholesaler carries a full line of Bridgeport Copper Water, Refrigeration and Drainage Tube. Ask for it by name.



Service lines of Bridgeport Copper Tube are easily installed for trouble-free permanent installation.



Overhead mains run the length of the building on copperized saddles to prevent wear.

Bridgeport Brass Co.

**BRIDGEPORT COPPER TUBE**

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

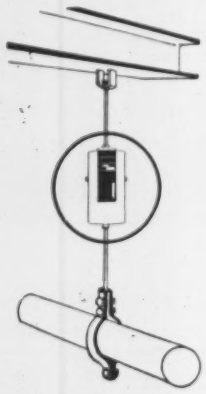
Bridgeport Brass Company, Bridgeport 2, Conn. • Sales Offices in Principal Cities • In Canada: Noranda Copper and Brass Limited, Montreal

"WITCH"

PIPE HANGERS

FOR

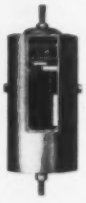
HEATING – PLUMBING
POWER & PROCESS



- Rugged
- Compact
- Simple in design and installation
- Indispensable for systems operating at changing temperatures

FIG. 401

SPRING HANGER



Our catalogue illustrates a *complete* line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

MAINTAINING OFFICES AND WAREHOUSES
ACROSS THE NATION

CARPENTER and PATERSON, Inc.

18 HURLEY ST., CAMBRIDGE, MASS.

## RECENT TRADE LITERATURE

*Continued*

plant, power instrumentation. Recommended by company for use with air, gas, vapors, liquids. Gages have tubes of bronze, drawn or bored stainless steel, other alloys, with movements, cases for variety of requirements. *Kunkle Valve Co., Dept. HPAC, 120 S. Clinton, Fort Wayne, Ind.*

▸ *PROCESS PUMP CONTROL*—Data sheet "A-58-2" describes "Dow-Hart" titrator in detail, includes schematic diagram, list of equipment with typical specifications. Unit offers method of continuous titration. Using controlled volume pumps for metering sample and standard solution, continuous titrator can be coupled with instrumentation for complete automatic control of process. With slurries, third liquid end to meter solvent or dilutent is used. This method described in data sheet. *Milton Roy Co., Dept. HPAC, 1300 E. Mermaid Lane, Philadelphia 18.*

▸ *PUMP CONTROLS*—Company's buyer's guide gives information on selection of proper controls for automatically controlling liquids at predetermined levels or pressures. Guide features simplified, integrated, interwired electrical control systems for starting, stopping, alternating pumps, motors, compressors on-site or remotely for reservoirs, elevated tanks, sumps, tankless systems. All systems, including telemetering, illustrated with photographs, sketches. *Automatic Controls Co., Dept. HPAC, 995 University Ave., St. Paul 4.*

▸ *RECORDING CONTROLLING THERMOMETERS*—Catalog "C60-2" describes complete line of rectangular case, filled system thermometers. Indicators, recorders, transmitters, electric or pneumatic control instruments detailed in 56 page publication. Vapor actuated, gas actuated and mercury actuated thermometers and thermal systems for use between —125 and 1000 F listed, explained, along with separable wells, other accessories. *Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.*

▸ *ROTARY JOINTS*—New, 8 page bulletin "5500-B" describes manufacturer's line of rotary joints for conveying steam, water, air, etc. Gives information on mechanical construction, exclusive engineering features, operating results. Diagrams illustrate three engineering principles for protection against leakage. Bulletin also covers selection, recommended installations, features such as compensation for wear, simplicity of repair. Table of sizes ½ to 2 in. also included. *Seamlex Co., Inc., Dept. 7-HPAC, 41-23 24th St., Long Island City 1, N. Y.*

### SUCTION OIL HEATERS

Compact, economical heaters. For use instead of pipe coils in bottom of tank. Only oil to be pumped is heated. Furnished with nozzle for welding to tank or with flange for bolting.

### FUEL OIL PREHEATERS

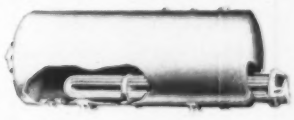
Heating of fuel oil prepares it properly for complete combustion in the burner. Work done by a good preheater, such as ADSCO Type "P", permits the use of heavier grade, less costly fuel oil.

### INSTANTANEOUS WATER HEATERS

Furnished as either steam tube or water tube type. Of simple U-bend design with removable element. For heating domestic or process water. Also used as a convertor for space heating.

### STORAGE WATER HEATERS

Wide choice of tank materials, including non-corrosive metals, or phenolic-resin lined steel. Welded construction in vertical or horizontal types. Removable U-tube element. Built to Code requirements.

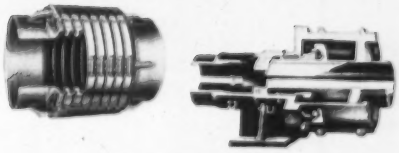


# ADSCO

## for complete heating and piping service

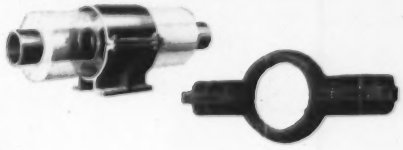
### EXPANSION JOINTS

ADSCO Corruflex Packless Expansion Joints require no maintenance and cost less than pipe bends. Sizes to 54". For pressures to 300 psi and higher, temperatures to 1600F. Various designs for special purposes. ADSCO also makes slip-type joints with long traverses and rigidly guided slips for high and low pressures and temperatures.



### PIPE LINE ACCESSORIES

Pipe alignment guides insure straight movement of pipe into expansion joint. Pipe anchors, for underground pipe lines, withstand full thrust of piping.



YUBA

**ADSCO DIVISION**

20 MILBURN STREET
BUFFALO 12, NEW YORK

YUBA CONSOLIDATED INDUSTRIES, INC.

## RECENT TRADE LITERATURE

*Continued*

▸ *SEALLESS PUMP*—Catalog "10.0" describes company's line of sealless pumps in plastic and stainless steel. Features, function, performance and application all covered in text. Catalog is illustrated, diagrammed; tables on construction, uses of pump also included. *Vanton Pump & Equipment Corp., Div. of Cooper Alloy Corp., Dept. HPAC, 201 Sweetland Ave., Hillside, N. J.*

▸ *SOLENOID VALVES*—Illustrated, 4 page brochure gives information on solenoid valves for nuclear reactors. Publication contains illustrations of many of company's solenoid valves for primary, secondary systems in pressurized water reactors. Specification, application data included. *Automatic Switch Co., Dept. HPAC, Florham Park, N. J.*

▸ *SPRINKLER PIPE*—Technical data sheets show how to install sprinkler pipe and obtain maximum efficiency from company's line of fastener in hanging pipe from structural steel, concrete beams, poured concrete ceilings. *Ramset Fastening System, Dept. HPAC, 12117 Berea Rd., Cleveland 11.*

▸ *STEEL BOILER TUBES*—Data card "TDC-157" lists maximum allowable working pressures, by popular tube sizes, for electric resistance welded boiler tubing. Information based on latest edition of ASME Boiler Construction Code, covers tubing for water tube, fire tube boilers. *Babcock & Wilcox, Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▸ *STEEL TUBING*—Buyer's guide bulletin "12-10" has selection chart with characteristics, size, response to fabrication, relative cost of seamless and welded, mechanical and structural, carbon steel tubing. Condensed information given on stainless steel and aluminum tubing and pipe and plastic pipe. *Joseph T. Ryerson & Son, Inc., Dept. HPAC, Box 8000-A, Chicago 80.*

▸ *TEMPERATURE CONTROLS*—"Condensed Catalog 400" is title of 8 page publication describing variety of local mounted and remote bulb temperature controls. Includes general purpose, dual switch, explosionproof, indicating type units. Bulletin contains 160 standard types, models, is illustrated, provides specifications. *United Electric Controls Co., Dept. HPAC, 79 School St., Watertown 72, Mass.*

▸ *TEMPERATURE AND HUMIDITY CONTROL*—Company's constant temperature and humidity control unit for testing laboratories covered in new, 4 page bulletin. Publication illustrates, gives information on self-contained control unit, including apparatus for heating, cooling, dehumidifying, circulating air into laboratory. Dry bulb temperatures may be maintained within ½ F, relative humidity within 1 percent. Bulletin includes photo of interior of testing room controlled by manufacturer's unit and reproduction of recorder chart indicating control main-

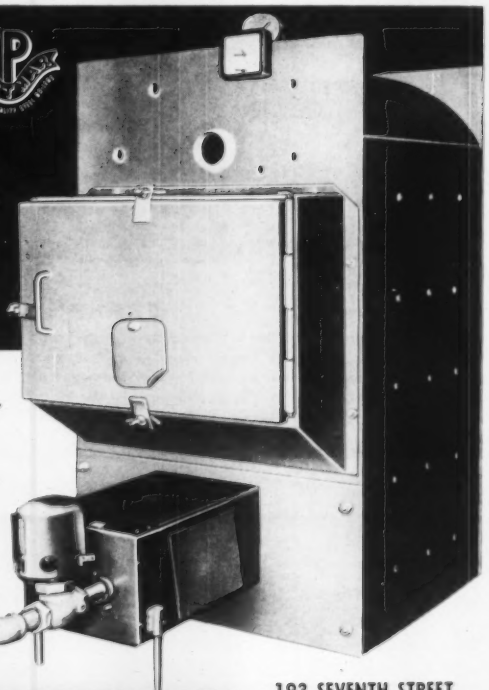

Portmar

HGU "COMMODORE" SERIES GAS HEATING STEEL BOILERS

FOR NATURAL, MANUFACTURED AND MIXED GASES

HORIZONTAL TUBE — EXTENDED WATERLEG CONSTRUCTION

Built-in gas refractory lining requires no combustion chamber. Simply slide burner into base plate opening and pipe gas line to burner for quick easy installation.



*For the heating and hot water supply requirements of small and large residential buildings and commercial installations.*

- horizontal, many-staggered tube design
- long gas travels completely absorb gases
- large furnace volume extracts full benefits of fuel
- compact, heavy duty door frame is of unique design
- instantaneous or tank type coils for year-round domestic hot water
- styled, flush and extended jackets

A.S.M.E. A.G.A.

AVAILABLE IN 15 SIZES

NET STEAM RATINGS: 400 to 5000 sq. ft.

NET FORCED WATER RATINGS: 720 to 9000 sq. ft.

Fully Automatic, Quality Engineered Gas Burner — multi-tube inshot type... quiet... efficient... dependable.

Portmar Boiler Company Inc.

193 SEVENTH STREET
BROOKLYN 15, N. Y.
TR·5·8777

RESIDENTIAL, COMMERCIAL, INDUSTRIAL WATER HEATERS AND HEATING BOILERS • VERTICAL, HORIZONTAL TUBULAR BOILERS • ROTARY FLAME BOILERS

# Kathabar® systems eliminate

# wet floors, walls, equipment, and products!

Think what it would mean to you if you could eliminate condensation and its corrosion problems from plant processing and storage areas, and keep work spaces dry even when they're hosed down regularly for sanitation.

Maintenance savings alone would improve your profit picture for the year. Increased life of your structures and equipment would pay long-term dividends. Storage losses from condensation would be a thing of the past.

Such profits are immediately available to you in a Kathabar-engineered air conditioning system.

**let's look at cases**

This sampling of Kathabar installations will show you how effective and versatile a Kathabar system can be.

**waterworks case**

Pipe galleries in a huge waterworks are completely surrounded by water as cold as 40 F. A Kathabar system maintains the air at below the water dew point, year-round, and eliminates condensation. This system paid for itself in less than three years.

**brewery case**

In the new cellars of a large midwestern brewery, a Kathabar system is earning profits by elimating condensation. Washdowns are less frequent; dry cellars curb bacterial growth. As a bonus benefit, the Kathabar system delivers the air at a maximum count of 4 Berratia Mercescens per cubic foot when the air entering the unit contains 40.

**candy case**

A candy manufacturer was plagued by condensation on the cooling slabs in his enrobing room. The moisture made his conveyor belt expand and jam. Chocolate and starch dust gummed up the belt and stopped production. A Kathabar system not only eliminated these problems, but increased production by 25%.

**marine case**

Kathabar systems in cargo ships and tankers provide anti-corrosion control, protection against cargo contamination, and ready gas freeing of all tanks. Kathabar systems quickly amortize themselves in maintenance savings, longer bulk-head life, better cargo protection, and faster turn-around.

**other cases**

Consulting engineers combine radiant panel cooling with Kathabar systems to dehumidify fresh air makeup. Colder water can be used in the panels, increasing efficiency without the danger of condensation.

Unitized Kathabar systems, using only electric power, dehumidify government storage caves. Completely portable, they are readily spotted to keep the dampest areas bone dry. Individual units avoid the fire hazard of a central system.

**who uses Kathabar systems**

Kathabar systems make profits out of air for these industries:

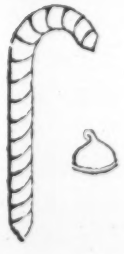
| | |
|---|---|
| Atomic Energy | Machining |
| Breweries | Marine |
| Cake Mix | Matches |
| Candy | Meat |
| Cellophane | Offices |
| Cellulose | Ordnance |
| Cereals | Paper |
| Chemicals | Pharmaceuticals |
| Coffee | Plastics |
| Comfort | Printing |
| Compressors | Rockets |
| Cookies | Rubber |
| Electronics | Sanitaryware |
| Explosives | Shellac |
| Film | Sugar |
| Foundries | Testing |
| Gelatin | Textiles |
| Glass | Transformers |
| Glue | Transistors |
| Gum | Vacuum Tubes |
| Hospitals | Varnish |
| Hotels | Waterworks |
| Lacquer | Wire |
| Lenses | Yeast |

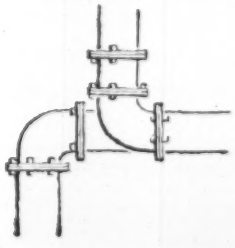
**how they use Kathabar systems**

Many of these industries use Kathabar systems for eliminating condensation. Others use them to (1) obtain continuous air at sub-freezing dry bulb and dew points; (2) maintain spaces below 80 F and 55% RH; (3) maintain spaces at specific low bacteria or mold count; and (4) improve drying processes.

**send description of your problem**

Air Conditioning and Drying Division
SURFACE COMBUSTION CORPORATION
2384 Dorr Street Toledo, Ohio





*Kathabar systems by*

Surface®

## RECENT TRADE LITERATURE

*Continued*

tained within laboratory set for 73 F dry bulb and 52 F dewpoint, corresponding to 50 percent RH. *J. O. Ross Engineering Div. of Midland-Ross Corp., Dept. HPAC, 444 Madison Ave., New York.*

▸ *UNIT AIR CONDITIONERS*—Bulletin "522-F" describes line of unit air conditioners, in sizes 3 to 15 tons. Each model illustrated with photos, diagrams; specifications for each also given. Text of publication describes suggested applications for units, outlines features of line. *Frick Co., Dept. HPAC, Waynesboro, Pa.*

▸ *UNIT VENTILATOR*—Catalog "DS-340" highlights company's "Kinetic Barrier" unit ventilator school conditioner with accessories. Special section shows typical unit, wide selection of ventilator accessories for custom installation in school. Catalog also includes data on hot water coils, control cycles, roughing-in drawings, dimensions, other aids to system design, equipment selection. Unit ventilator available in wide range of capacities, two models, nine cabinet styles for steam and hot water systems. *Trane Co., Dept. HPAC, La Crosse, Wis.*

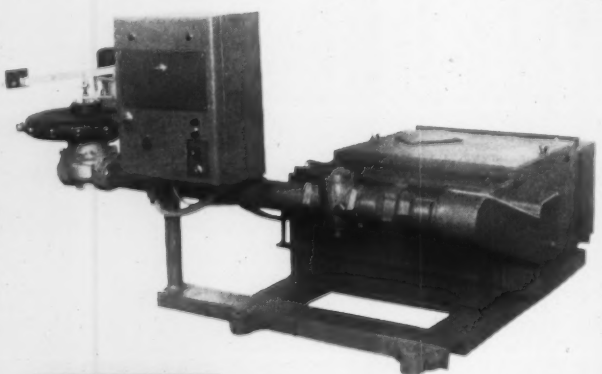
▸ *VIBRATION MOUNTINGS*—Bulletin "EGB" gives application data, prices for machine tool mountings intended to simplify installations, increase production. Illustrated bulletin includes information on how to determine if steel springs, rubber or cork should be used as machine mountings; how to determine size, quantity of mountings needed; prices for all sizes of three types of mountings available from stock. *Korfund Co., Inc., Dept. HPAC, 48-01F 32nd Pl., Long Island City 1, N. Y.*

▸ *VIBRATION MOUNTINGS*—Technical data bulletin company's color-coded type "R" series of neoprene-in-shear mountings. Oil resistant shock, vibration mountings available in five sizes, five degrees of hardness for loads 10 to 4000 lb per mounting. *Vibration Mountings, Inc., Dept. HPAC, 98-15 50th Ave., Corona 68, N. Y.*

▸ *WATER FILTRATION*—Uses of manufacturer's couplings on filtration plant piping in water treatment plants in operation is subject of 8 page catalog "Form No. 158." Contains photos illustrating use of couplings on discharge lines, pump and valve connections, raw water lines, chemical lines. *Dresser Mfg. Div., Dresser Industries, Inc., Dept. HPAC, 49 Fisher Ave., Bradford, Pa.*

▸ *WATER TREATMENT*—Illustrated instruction folder describes company's line of water treatment products for evaporative condensers, cooling tower systems, ice making machines, chilled water systems. Contains instructions on use of products, including charts. *Micromet Dept., Calgon Co., Dept. HPAC, Hagan Bldg., Pittsburgh 30.*


*No. 1 of a Series*



The KINEPACK*

COMBUSTION EQUIPMENT

ENGINEERED BY THE WEBSTER ENGINEERING COMPANY

★ Trade Mark

# PACKAGED COMBUSTION by Webster

A completely piped, wired and tested factory assembly consisting of the famous WEBSTER KINETIC Gas Burner, manual firing valve, automatic diaphram gas valve and an electronic combustion safeguard system incorporating the RA 680 cabinet.

Available in three sizes with eight capacities from 800,000 to 3,260,000 Btu/hr.

*Write for illustrated Bulletin # B8/30*

The **WEBSTER ENGINEERING** Company

**TULSA 16, OKLAHOMA**

*Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio*

*Every engineer should know how...*
*CHRYSLER'S AIRTEMP minimizes*

# The 3 "Secret Costs" of Air Conditioning

**Initial price is no guide to the real cost of air conditioning**

**Real cost is determined by long-term expenses versus long-term savings**

When you specify air conditioning, remember—the best costs less in the long run. The best-quality air conditioning your client can buy is Chrysler's Airtemp. Yet, in terms of real cost, Airtemp is also the least expensive. Why? Because Airtemp reduces the long-term 3 "secret costs" of air conditioning.

**THE SECRET COST OF WRONG EQUIPMENT**
The wrong equipment can be troublesome as well as costly to operate. Airtemp makes all kinds of air conditioners—over 297 models—and can advise you on which is best for your client's needs. You're sure to get exactly the right equipment from Airtemp!

**THE SECRET COST OF OPERATION**
Operating costs over a few years may actually exceed the first cost of air conditioning. But rock-bottom operating costs can save substantial sums. That's why you should know that AIRTEMP—thanks to Chrysler engineering—promises the lowest operating costs in the industry!

**THE SECRET COST OF MAINTENANCE**
Maintenance costs and repair costs can be a shock. A breakdown brings repair bills PLUS the cost of lost time, lost business. But Airtemp air conditioning is carefully engineered by Chrysler for trouble-proof operation. And Airtemp is installed only by qualified contractors, who must certify to Airtemp that equipment warranted for 5 years has been installed properly. That's why Airtemp maintenance costs average out to be the lowest in the industry!

May we give you the complete facts? For prompt action mail the coupon below. Or phone your nearest Airtemp contractor or dealer who is listed in the Yellow Pages.

CHRYSLER

Airtemp

**AIRTEMP DIVISION, CHRYSLER CORP.**
**Dept. HP-7-58, Dayton 1, Ohio**
Please send us information on how Airtemp controls the 3 "secret costs" of air conditioning.

Name_____
Address_____
City_____ Zone____ State_____
Firm Name_____

# SIMPLE—4-step water treatment IMPROVES Air Conditioning

End scale, slime and corrosion troubles in air conditioning water with Oakite Airefiner No. 52. All it takes is a ten-minute daily check up by one man. This way you maintain high cooling efficiency and you reduce out-of-service time, too.

How? With a simple four step program. (1) Charge water initially with Oakite Airefiner No. 52. (2) Test water daily. (3) Add upkeep when necessary. (4) Drain system and replace with new, charged water on a periodic basis.

That's all there is to it. Airefiner No. 52 checks slime and algae growth, prevents scale build-up and minimizes corrosion. It leaves tubes clean for efficient heat exchange. It's safe. It's inexpensive.

For explanatory drawings and full details on this time and trouble saving method, ask your local Oakite Technical Service Representative, or write Oakite Products, Inc., 51A Rector Street, New York 6, N. Y.

OAKITE

*specialized*
**WATER TREATING**
*materials*

*In our 50th year*

Technical Service Representatives in Principal Cities of U. S. and Canada


## WHO'S WHAT...

***(New personnel, promotions)***

▸ *MARCO INDUSTRIES, INC.*—R. P. Ballou, vice president—engineering.

▸ *WALWORTH CO.*—John C. Wallace, vice president, operations.

▸ *BALTIMORE AIRCOIL CO., INC.*—John Engalitcheff, president, elected to board of directors of Air-Conditioning and Refrigeration Institute.

▸ *CRUCIBLE STEEL CO. OF AMERICA*—L. L. Ferrall, executive vice president; J. D. Dickerson, vice president—operations.

▸ *WESTINGHOUSE ELECTRIC CORP.*—Thomas Hancock, executive vice president of air conditioning division, elected to board of directors of Air-Conditioning and Refrigeration Institute.

▸ *AMERICAN MFG. CO.*—Henry O. Kirkpatrick, general manager, elected to board of directors of Air-Conditioning and Refrigeration Institute.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—V. D. Wissmiller, market manager of commercial div., elected to board of directors of Air-Conditioning and Refrigeration Institute.

▸ *WATTS REGULATOR CO.*—George C. Scott, application engineer.

▸ *ARMSTRONG CORK CO.*—A. R. McGarvey, acting manager of industrial insulation department; C. L. Carlson, acting manager of the adhesives department, industrial products research.

▸ *BATELLE MEMORIAL INSTITUTE*—David W. Locklin, mechanical engineering department staff member.

▸ *AMERICAN AIR FILTER CO., INC.*—John J. Willis, vice president; John M. Kane, manager of dust control products department, elected director of American Industrial Hygiene Association.

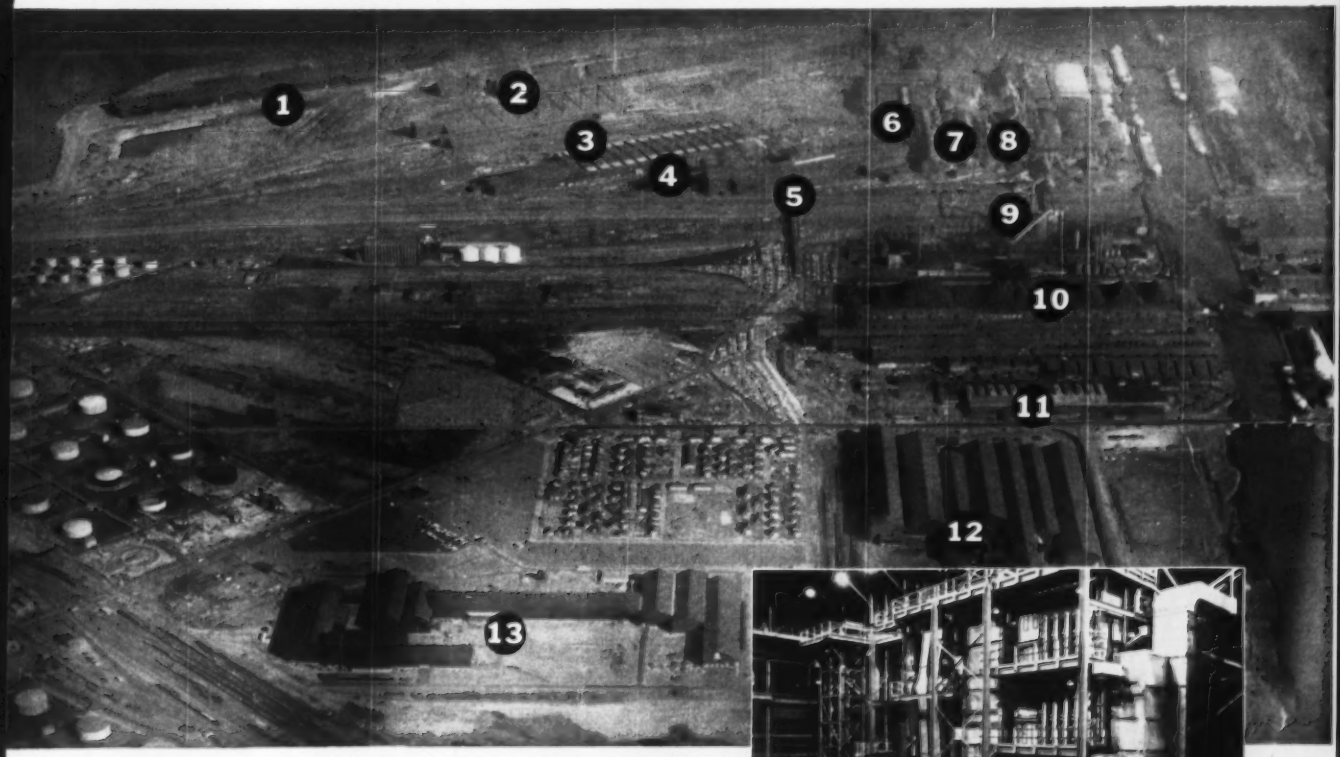
▸ *CEILHEAT, INC.*—Jack Witherspoon, Jr., chief engineer in charge of design.

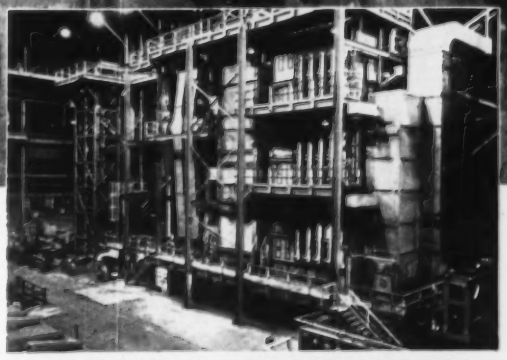
▸ *CLEAVER-BROOKS CO.*—William F. Zunker, sales manager, industrial boiler division.

# Birdseye view of the future...

**Youngstown's Expansion Program provides more quality steel for Mid-America**

The hustle, the feel of the future and the booming spirit of expansion . . . this is the spirit of Youngstown. The birdseye view shows our Indiana Harbor facilities where we are putting this spirit to work in the Chicago area. In addition to our No. 2 Blooming Mill (2), No. 2 Open Hearth Shop (3), Merchant Mill (4), No. 1 Open Hearth Shop (5), Billet and Skelp Mill (6), Continuous Weld Pipe Mills (7), Blast Furnaces (8), Coke Plant (10), Strip and No. 1 Tin Mills (11), the Cold Reduced Sheet Mill (12) . . . our new No. 3 Seamless Tube Mill (1), our new (9) Sintering Plant (construction began in March 1958) and our new No. 2 Tin Mill (13) are shown. These last three expansions are pointed directly at the growing markets of the Mid-Continent. Like the pioneers who made America the great nation it is, Youngstown moves toward new horizons . . . new ways to supply your steel needs through quality products and friendly, efficient service!



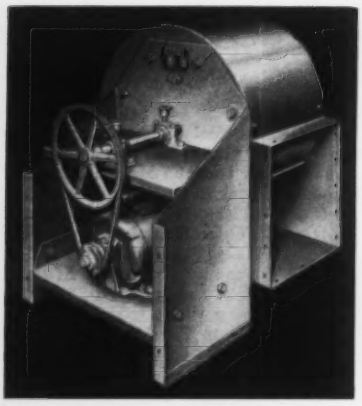
*Huge new Continuous Annealing Line in our No. 2 Tin Plate Mill, Indiana Harbor Plant.*

*The world's largest Rotary Billet-Heating Furnace in our No. 3 Seamless Tube Mill, Indiana Harbor Plant.*

THE
**YOUNGSTOWN**
SHEET AND TUBE COMPANY

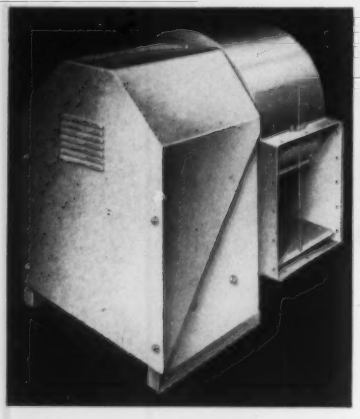
*Manufacturers of Carbon, Alloy and Yoloy Steel, Youngstown, Ohio*

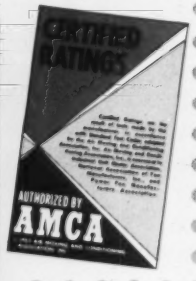
PLANTS AT YOUNGSTOWN, OHIO AND INDIANA HARBOR, INDIANA



Aladdin
AIR HANDLING EQUIPMENT

UTILITY SETS






**TEN SIZES • COMPACT • BELT DRIVEN**
**SELF CONTAINED • QUIET OPERATING**

**ALADDIN Belt-Driven Utility Sets** are extremely quiet in operation. Designed for general ventilation, they occupy a minimum of space, handling large volumes of air at low noise levels. They are ruggedly built and are ideally suited for roof installation . . . when furnished with weatherproof cover they require no further protection against the weather.

ALADDIN Utility Sets are available with both forward curved or backwardly inclined blade wheels.

***Write for complete data***

**ALADDIN HEATING CORPORATION**
**1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA**


## WHO'S WHAT

*Continued*

▸ *DELAVAN MFG. CO.*—Jack O. Hill, sales engineer.

▸ *PYLE-NATIONAL CO.*—Robert F. Dick, elected to board of directors.

▸ *RIC-WIL INC.*—Edward L. Logrbrinck, director of marketing.

▸ *ACRO DIV. of ROBERTSHAW-FULTON CONTROLS CO.*—M. S. Feltz, marketing manager.

▸ *PENN CONTROLS, INC.*—Grover M. Russell, chief engineer.

▸ *BRUNNER DIV. of DUNHAM-BUSH, INC.*—D. Roger Beaupre, plant superintendent.

▸ *FLEXONICS CORP.*—E. L. Hiter, general manager of new expansion joint division.

▸ *STONE & WEBSTER ENGINEERING CORP.*—Robert S. Boyd, manager of appraisal division.

▸ *TRANE CO.*—Thomas Noddings, appointed to transportation sales department; E. E. Ballard, Jr., manager of Canton, Ohio, sales office, elected president of Canton Regional Society of Professional Engineers.

▸ *FOSTER WHEELER CORP.*—John M. West, sales promotion manager.

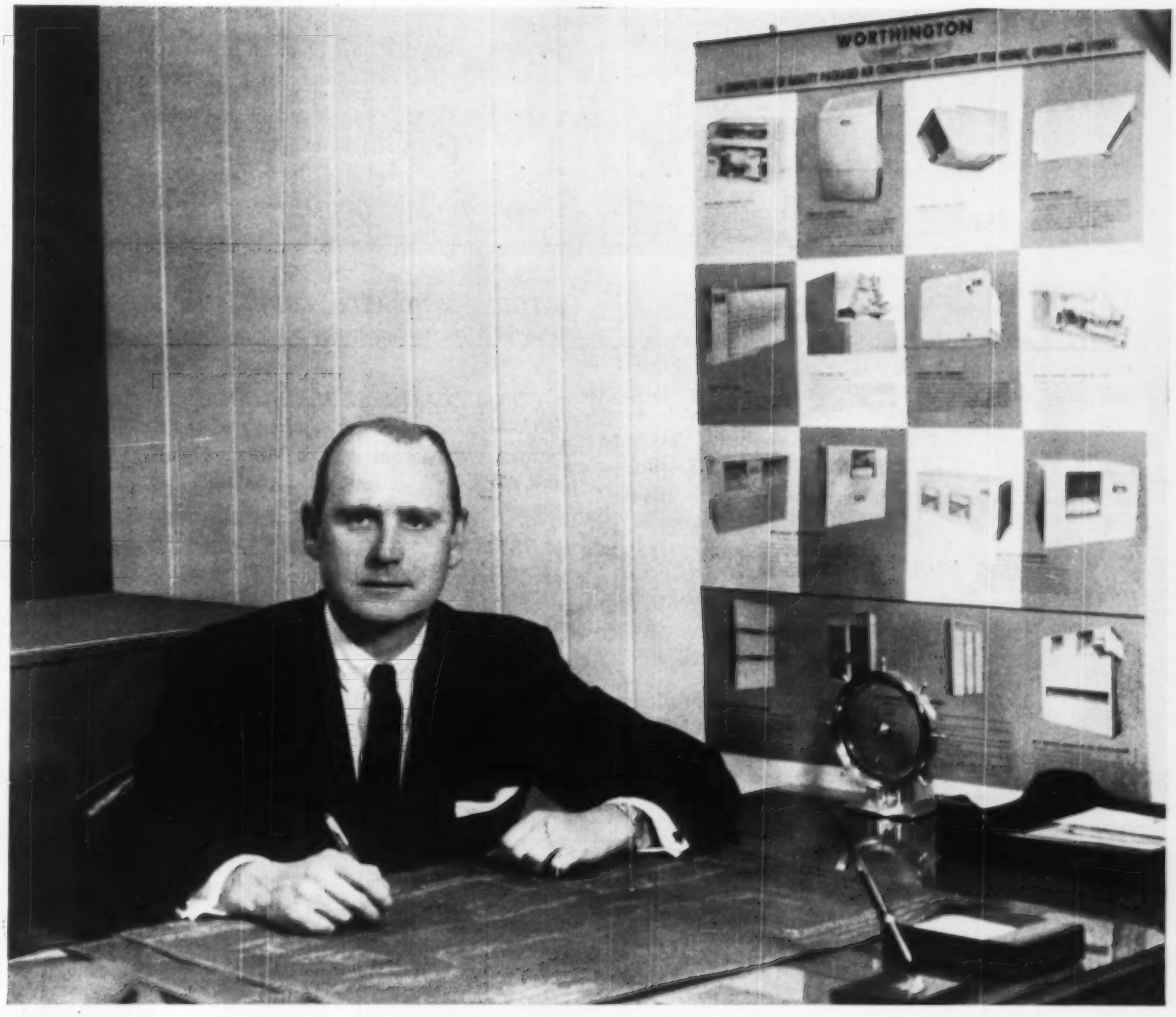
▸ *GENERAL RUBBER CORP.*—Robert W. Vonder Lieth, sales manager of special products division.

▸ *TUBE TURNS, DIV. of CHEMETRON CORP.*—Richard H. Fogarty, pipe welding engineer.

▸ *UNIVERSAL DIFFUSER CORP.*—William H. Neekamp, general sales manager.

▸ *FITZGIBBONS BOILER CO., INC.*—James C. Woodson, manager of marketing and sales promotion.

▸ *FLEXIBLE TUBING CORP.*—James T. McFarland, assistant sales manager—western operations; William S. Urquart, factory superintendent at company's new plant in Anaheim, Calif.




## Complete-line air-conditioning lets Worthington dealers

# CUSTOM-QUOTE EVERY JOB!

Probably the most complete line of air conditioning equipment in the world—*Worthington, naturally*—is signing on a select group of new air conditioning dealers—*yourself, possibly?*

Many, many different models permit these *fortunate* dealers to put together the most efficient and economical combinations of air conditioning equipment for any *specific* job. Handling *exactly* the right equipment for every air conditioning problem eliminates equipment compromises, means these *smart* dealers can "custom-quote" on every job. And behind this job-tailored equipment stands 70 years of respected Worthington experience and front-line service. (Incidentally, these same *intelligent* new dealers will find that Worthington equipment is backed by a 5-year warranty which includes a generous dealer labor allowance.)

Interested in quoting on equipment fashioned to the job, not jobs fashioned to the equipment? Interested in increasing your sales, cutting down on lost orders? If so, *Worthington wants you—and you'll want Worthington.* Write today for the complete air conditioning story. Worthington Corporation, Air Conditioning and Refrigeration Division, Section 12-4, Harrison, N. J.

## WORTHINGTON

WORTHINGTON'S COMPLETE COMMERCIAL AND INDUSTRIAL AIR CONDITIONING LINE INCLUDES:

**Flexi-cool line**: Air-cooled, ceiling-mounted, split systems • Water-cooled, self-contained, ceiling-mounted units • Smallest floor-mounted unit available • Hang it, lay it down, stand it up Vertical and Horizontal cooling coils • Remote water-cooled packaged unit • Water-cooled self-contained packaged unit • Air-cooled packaged units • Air-cooled condensers • Air-cooled condensing units • Packaged water chillers—hermetic and open • Reciprocating compressors • Air handling units • Evaporative coolers • Evaporative condensers • Fan and coil units

## WHO'S WHAT

*Continued*

▸ *BLAW-KNOX CO.*—W. W. Weeks, manager of power piping for company's power piping and sprinkling division.

▸ *A. M. BYERS CO.*—Edward A. Reynolds, manager of quality control.

▸ *OSTER MFG. CO.*—Robert C. Baumgartner, vice president; Richard Humiston, treasurer; Clare R. Metcalf, sales manager.

▸ *W-K-M DIV. of ACF INDUSTRIES, INC.*—Robert D. Butler, assistant to sales manager—plug valves.

▸ *WOLVERINE TUBE DIV. of CALUMET & HECLA, INC.*—Eugene F. Hill, market manager of new products division.

▸ *DRAVO CORP.*—William D. Bickel, vice president and general manager of machinery division; John K. Beidler, vice president, commercial; Harold R. Mantle, assistant to the executive vice president.

▸ *INSUL-FIL CO.*—William C. Agnoli, general sales manager; Harry E. Rapp, technical director.

▸ *JOY MFG. CO.*—John W. Wade, works manager of New Philadelphia, Ohio, plant.

▸ *BETZ DIV. of BOHN ALUMINUM & BRASS CORP.*—Jack Searls, general sales manager.

▸ *TODD SHIPYARDS CORP.*—John M. English, general sales manager for all manufactured products.

▸ *CONSOLIDATED EDISON CO. OF NEW YORK, INC.*—Louis J. Wagner, manager of sales engineering bureau, elected chairman of Metropolitan Gas Heating and Air Conditioning Council.

▸ *DETROIT STOKER CO.*—Herbert L. Wagner, vice president and general manager.

▸ *NATIONAL-U.S. RADIATOR CORP.*—Dr. Walter L. Ross, director of company's new division for advance engineering at research center in Johnstown, Pa.; John W. Hall, manager of field promotion for heating and air conditioning division; David Goldenberg, manager of corporation's development laboratory.


When price is NOT the Answer!...

**Schools need dependable sump pumps that provide years of trouble-free service**

In selecting a sump pump for school installations first consideration must be given to long life, low maintenance costs and enduring dependability.

The Electric Water Boy is designed and manufactured to meet all of these requirements.

Heavy duty motor with a high starting torque prevents stalling. An overload relay protects the motor. Permanently lubricated extra heavy ball bearings insures a long life.

The Electric Water Boy pumps are conservatively rated and precision made of the finest materials.

**Construction**

Bronze impeller, adjustable steel coupling, capacitor motor, rigid hanger pipe and rugged construction thruout insure long life. Send for Bulletin F 501 C.

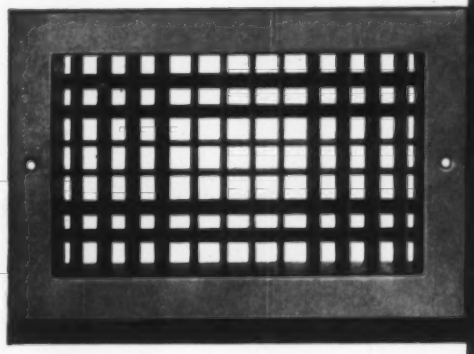
**Specify and Install the Electric Water Boy**

***Available for immediate delivery from Factory Stock***

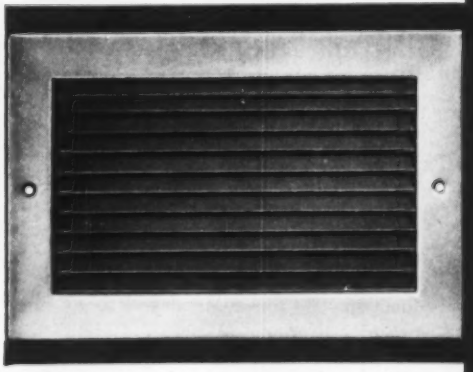
weil **PUMP COMPANY**

1514 No. Fremont St., Chicago

# What makes WATERLOO the buy-word in grilles?



**Style 2V Supply Grille**
Two sets of adjustable louvres, front vertical, rear horizontal.



**Style 3H Return Air Grille**
One set of horizontal fins fixed down at 45° deflection... Also available in 0° deflection.

### 55 YEARS' EXPERIENCE

Since 1902, the Waterloo Register Company has been a leader in the development of registers and grilles for air conditioning, heating and ventilating applications. This 55 years of experience helps us make the finest equipment available today.

### EXCLUSIVE DESIGN

Waterloo registers and grilles feature the silent flow "tear drop" louvre design, which allows a streamlined flow of high-velocity air, maintaining the required throw at the most efficient level.

### QUALITY CONTROL

Every Waterloo register and grille is manufactured in a modern plant using the most efficient manufacturing techniques. There is rigid inspection at every vital step.

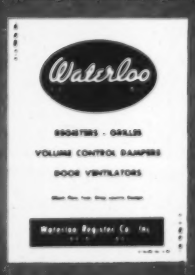
### WIDE RANGE LINE

Whatever your specific needs, you will find the unit you want in Waterloo's complete line of supply and return registers and grilles. We also manufacture quality volume control dampers and door ventilators.

### FAST SERVICE

Waterloo delivers . . . when you need it! Specials can be turned out in a hurry to meet job requirements.

These are *five* good reasons why it pays to make Waterloo your *buy-word*.




Write for Catalog, containing complete data on all Waterloo air diffusion equipment.

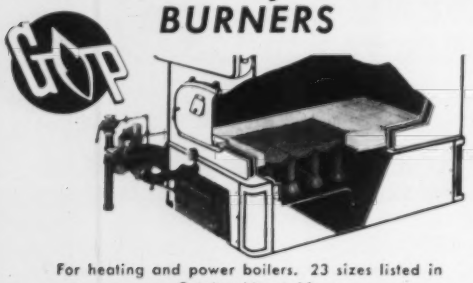
**WATERLOO**
**REGISTER CO., INC.**
**WATERLOO, IOWA**

WR 100

REGISTERS • GRILLES • VOLUME CONTROL DAMPERS • DOOR VENTILATORS

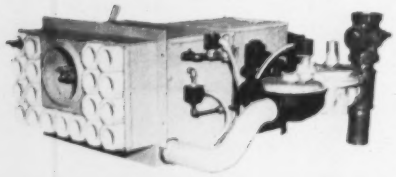
"Planned Performance"*

BURNERS



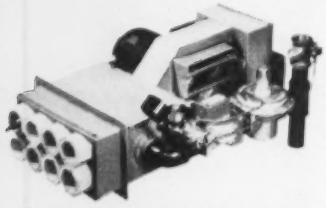
For heating and power boilers. 23 sizes listed in Catalog No. A-10.

BLUE LINE UPSHOT ATMOSPHERIC GAS BURNER



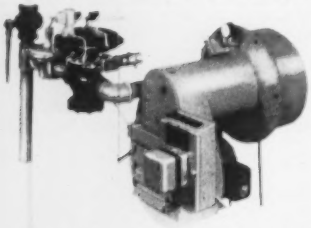
Retracted oil nozzle on gas firing. Sizes up to 30 GPH light oil. Catalog E-30.

DUO-FLAME COMBINATION GAS-OIL BURNER



Fully automatic, forced draft. Sizes listed to 28 million BTU/HR in Catalog C-10.

TURBO-FIRE POWER TYPE GAS BURNER



No stack required on boilers equipped for pressure firing. Sizes up to 10 million BTU/HR in Catalog C-15.

SCOTCH MARINE TYPE FGR PRESSURE BURNER

* PLANNED — Factory assembled, pre-wired for "Bolt-in" installation.

* PERFORMANCE — Custom matched to individual boilers for quiet, efficient operation.

Gordon & Piatt also manufacturer of a complete line of domestic conversion burners plus large dual-fuel units. Write for literature and complete information.

Gordon & Piatt

P. O. Box 914
Winfield, Kansas


## WHO'S WHAT — *Continued*

▸ *A. W. CASH VALVE MFG. CORP.*—Ralph D. Hiser, sales manager of custom products in industrial division.

▸ *COPELAND REFRIGERATION CORP.*—J. E. Perry, application engineer.

▸ *WARREN WEBSTER & CO.*—A. N. Clark, Jr., manager of advertising and sales promotion.

▸ *DRAYER-HANSON DIV. of NATIONAL-U.S. RADIATOR CORP.*—Frank Chambers, sales engineer.

▸ *ALL-STATE WELDING ALLOYS CO., INC.*—John F. Donnelly, director of technical sales training.

▸ *DE LAVAL STEAM TURBINE CO.*—C. E. Cromwell, manager of commercial sales.

▸ *KEASBEY & MATTISON CO.*—Frederick E. Hawkins, assistant development manager.

▸ *AMERICAN STANDARD PLUMBING AND HEATING DIV.*—Francis J. McGrath, general sales manager.

▸ *ALLIS-CHALMERS MFG. CO.*—Clinton F. Kucera, manager of New York district office of the company.

▸ *LIMBACH CO.*—Walter F. Limbach, president, elected president of The Sheet Metal and Air Conditioning Contractors' National Association, Inc.

▸ *AMERICAN AIR FILTER CO., INC.*—Donald H. Ninow, manager of Moline, Ill., branch office.

## IN THE TERRITORIES . . .

***(Recent sales appointments)***

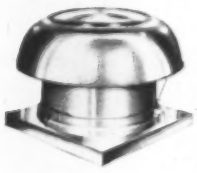
▸ *H. K. PORTER CO., INC.—QUAKER RUBBER DIV.* and *LESCHEN WIRE ROPE DIV.*, joint sales and service branch office at 450 Second St., New Kensington, Pa., to serve West Virginia, eastern Ohio and western Pennsylvania.

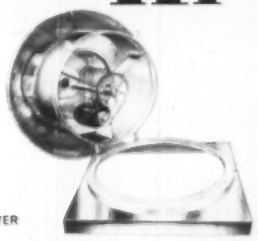
▸ *AIRTEMP DIV., CHRYSLER CORP.*—Warren Fitch, manager of northeast sales zone, with headquarters in Leonia, N. J.; W. L. Regan, southeast zone manager.

JENN-AIR LAUNCHES

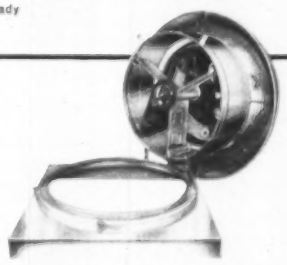
TWO NEW STARS INTO ORBIT

# Hi-D CENTRIFUGAL AND AXIAL POWER ROOF EXHAUSTERS





HI-D CENTRIFUGAL POWER ROOF EXHAUSTER
Unit in open position showing ready access to drive assembly.



HI-D AXIAL POWER ROOF EXHAUSTER
Unit in open position showing ready access to drive assembly.

**Observe These Outstanding Features Shared in Common by 2 New Jenn-Air Hi-Discharge Exhausters:**

1—*Maintenance-Free all-aluminum housing* supplies strength without weight.

2—*Bird guard* of heavy gauge stainless steel construction comes as an integral part of every unit.

3—*Special vibration absorbers* reduce noise to an absolute minimum.

4—*Totally enclosed* full ball bearing, permanently lubricated, motor assures smooth, uninterrupted service. Air cooled application adds years to motor life.

5—*Tubular drive assembly* has permanently sealed, pre-lubricated ball bearings.

6—*Motor and drive* can be serviced from interior of building, if desired.

7—*Specially designed hinge* on housing permits ready access to damper and drive. Positive stopping device holds unit in open position. Simple locking mechanism keeps it tightly closed.

**Now, for the first time, aluminum belt driven units combine high discharge with low-contour appearance**

Since 1947 the power exhauster industry has looked to Jenn-Air for leadership. Now Jenn-Air starts its second decade by introducing two new and useful additions to its line: Hi-Discharge *Centrifugal* Power Roof Exhauster, Series HCB; and Hi-Discharge *Axial* Power Roof Exhauster, Series HAB. These exhausters fill the need for general area ventilation and have a clean engineering design that features compactness and serviceability. By locating the wheel at the top you derive the advantage of a high point of discharge which allows low curb construction. Thus, Jenn-Air units offer the lowest overall height of any exhauster on the market. Once you compare, you will decide on Jenn-Air.

**JENN-AIR PRODUCTS COMPANY, INC.**
1102 Stadium Drive • Indianapolis 7, Indiana

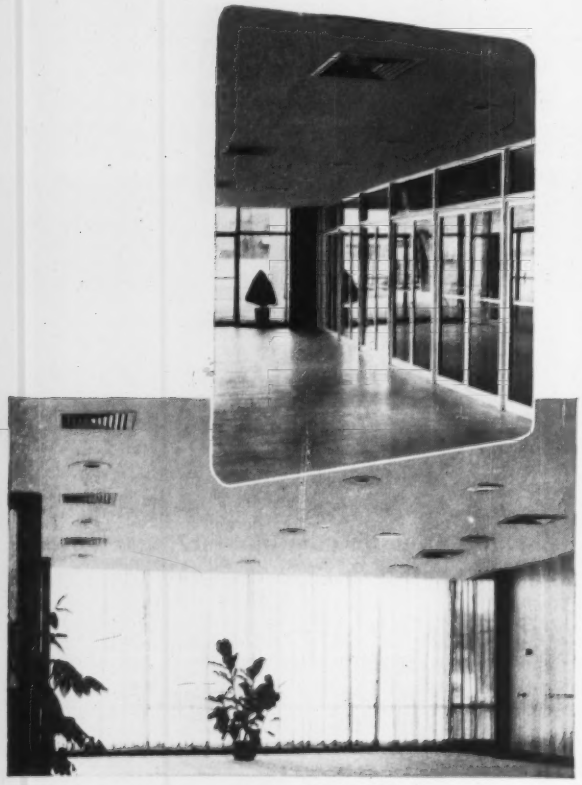
*Member of Air Moving and Conditioning Association*

AGITAIR®

*Custom Made*

SQUARE and RECTANGULAR

**AIR DIFFUSERS**



Custom made in unlimited air patterns, AGITAIR square and rectangular air diffusers suit all job conditions... blend perfectly with any interior design.

These AGITAIR diffusers need not be centrally located. They assure draftless, noiseless, equalized air distribution from any location in the ceiling or side wall.

*Write for Catalog R107 for complete data.*

THERMOTANK AGITAIR

high velocity units • punkah louvers
air diffusers • filters • exhausters

*Sold exclusively by representatives for:*

**AIR DEVICES INC.**

185 MADISON AVENUE, NEW YORK 16, N. Y.

## WHO'S WHAT *Continued*

▸ *THERMOBLOC DIV. of PRAT-DANIEL CORP.*—Chas. F. Childress Co., sales engineers for southwest Ohio, Kentucky, part of southeast Indiana; C. E. O'Brien Co., Dayton, sales engineers for south central Ohio.

▸ *PETROMETER CORP.*—Lee M. Ragsdale, Jr., representative for eastern Tennessee and western corner of Virginia, with offices in Knoxville, Tenn.

▸ *AMERICAN BLOWER, DIV. of AMERICAN STANDARD*—Russell L. Johnson, southwestern division merchandise manager.

▸ *BRUNER CORP.*—Stickler and Downs, Milwaukee, appointed factory representative in Wisconsin.

▸ *DRAYER-HANSON, DIV. of NATIONAL-U.S. RADIATOR CORP.*—Rocky Mountain Aircold Co., Denver, sales agent for air conditioning and refrigeration in the Mountain States.

▸ *FRICK CO.*—Powers Refrigeration, Los Angeles, distributor in southern California, Arizona and Clark County, Nevada.

▸ *OLD DOMINION IRON & STEEL CORP.*—Parker Devlin Agency, Westport, Conn., sales representative for Connecticut; Plasse Industrial Co., New York, sales representative for Metropolitan New York and Long Island; Merit Steam Specialties and Sales, Verona, N. J., sales representative for northern New Jersey.

▸ *FARR CO.*—Air Filter Sales and Service Co., Kansas City, Mo., sales and filter service representative for Kansas City territory.

▸ *DRAYER-HANSON, DIV. OF NATIONAL-U. S. RADIATOR CORP.*—Bill Walsh, Pacific Monitor, Seattle, representative in Pacific Northwest.

▸ *ARONSON MACHINE CO.*—William L. Fisher, eastern district sales manager.

▸ *CLEAVER-BROOKS CO.*—John F. Mahar and Robert Martin, appointed boiler sales engineers in state of New York.

▸ *CONOFLOW CORP.*—E. B. Miller Co., St. Louis, has been appointed sales agent in eastern Missouri and southern Illinois.

# Are You Missing The Profit Parade?

As the chart at right shows, copper drainage tube DWV is being used more and more by wide-awake contractors. Don't let this opportunity slip past you . . . ride the trend and profit. Here are the reasons for that trend:

1. Reports from contractor after contractor show installed cost to be lower than for rustable materials.
2. Every step of installation is quicker, easier.
3. Largest size in 20′ lengths can be handled by one man. Fewer hangers are required.
4. Copper can't rust . . . is virtually impossible to clog.
5. Fewer, tighter joints.
6. 3″ stack fits 2″ x 4″ wall partition.
7. Ideal for prefabrication in shop.
8. Copper is accepted by builders and owners as the badge of quality construction.

JOIN THE PROFIT PARADE NOW! SEE YOUR REVERE DISTRIBUTOR FOR SIZES AND COMPLETE DETAILS OR SEND FOR FREE DATA FOLDER

**REVERE COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*
230 Park Ave., New York 17, N. Y.
Mills: *Rome, N.Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.*

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

**IN 2 YEARS THE USE OF TYPE "M" AND DWV COPPER TUBE HAS INCREASED 29%**

| Size | 1st Half 1955 Type M | 1st Half 1955 DWV | 1st Half 1956 Type M | 1st Half 1956 DWV | 1st Half 1957 Type M | 1st Half 1957 DWV |
|---|---|---|---|---|---|---|
| 1¼″ | 2.7 | .1 | 2.1 | 0.5 | 1.9 | 0.7 |
| 1½″ | 4.6 | .5 | 2.9 | 2.6 | 2.6 | 4.2 |
| 2″ | 1.8 | .2 | 1.5 | 0.8 | 1.3 | 0.9 |
| 3″ | 1.8 | .5 | 1.3 | 1.5 | 1.1 | 2.7 |
| 4″ | 0.2 | ** | 0.2 | 0.1 | 0.3 | 0.3 |
| Total | 11.1 | 1.3 | 8.0 | 5.5 | 7.2 | 8.8 |
| TOTAL | 12.4 | | 13.5 | | 16.0 | |

Distribution expressed in lbs. per Housing Start. **Less than 0.05

Source: U.S. Dept. of Labor

Above table shows results of recent survey made by U.S. Department of Labor on the use of Type "M" Copper Water Tube and Copper Drainage Tube DWV, as determined by shipments. Note that while use of Type "M" has decreased 35%—1957 over 1955, Type "DWV" has increased a phenomenal 575% for the same period.

*Available* **NOW!**

# INDUSTRIAL VENTILATION MANUAL

- **Revised equation for oven ventilation.**
- **New material on ventilation of radioactive and high-toxicity contaminants.**
- **16 new hood designs, 33 revised hood designs.**
- **New material on air cleaning for radioactive contaminants.**
- **Revised equation for airflow into hoods.**
- **Revised table for collectors in industry.**
- **New chart on comparison of air filter characteristics.**
- **Revised, up-to-date table of maximum allowable concentrations.**
- **Revised table of physical constants.**

Here's the biggest and most comprehensive Industrial Ventilation Manual yet — over 200 pages, containing more than 200 diagrams, 52 tables of ventilation material and 13 ventilation charts.

The Ventilation Manual contains all the information needed for the complete design of industrial ventilation systems. It is the official publication of the American Conference of Governmental Industrial Hygienists and is used as a basic text by leading universities. The recommended ventilation practices are approved by Federal, State and Municipal Government Industrial Hygiene Departments.

**JUST $4 — MAIL COUPON TODAY!**

Committee on Industrial Ventilation
P. O. Box 453, Lansing 2, Michigan

Enclosed please find $_____ for _____ copies of the new 5th edition of the Industrial Ventilation Manual.

Name _____

Firm _____

Address _____

City and State _____


## WHO'S WHAT

*Continued*

▸ *W. D. ALLEN MFG. CO.*—James E. Christie, V. J. Boyd, Charles Pacher, C. Arnold Pacher, G. Martin Rahe, field consultants.

▸ *TRANE CO.*—D. N. McMinn, sales engineer in Indianapolis office; C. J. Witt, sales engineer in Tulsa sales office; Whitesell Refrigeration, Hamilton, Ohio; Carolina Sales Corp., Greenville, N. C.; Air Conditioning and Heating Co., Nashville, Tenn.; General Heating & Air Conditioning, Dallas; Drake Co., Inc., Fort Worth; Edward Cooling and Heating Co., Cincinnati; Haggerty & Son, Philadelphia; J. Lawrence Hall Co., Nashua, N. H.; E. A. Wilson Co., Lowell, Mass.; Brockton Air Conditioning and Sheet Metal, Brockton, Mass.; Ultra Comfort Engineering Co., Inc., Roxbury, Mass. Hancock Engineering Corp., Boston; all named authorized sources for company's package equipment.

▸ *COPELAND REFRIGERATION CORP.*—Ray Whitehead, district manager for the Eastern Seaboard.

▸ *CYCLOTHERM DIV., NATIONAL-U. S. RADIATOR CORP.*—F. J. Evans Engineering Co., Inc., Birmingham, Ala., appointed sales distributor.

▸ *AUTOMATIC SWITCH CO.*—Frank D. Riggio Co., Inc., authorized stocking distributor in Rutherford, N. J.

▸ *RECOLD CORP.*—P. H. Hutchinson and Associates, Pensacola, Fla., representative in northwest Florida and southern Alabama.

▸ *GIBSON REFRIGERATOR CO.*—Sylvania Sales Corp, Buffalo, N.Y., area distributors.

▸ *SCHEMENAUER MFG. CO.*—Frontier Engineer Service, Salt Lake City, western division sales office; Robert Sparks, sales representative for Iowa and part of Nebraska.

▸ *DUNHAM-BUSH, INC.*—Clifford J. Kimmel, sales manager for *BRUNNER DIV.* subsidiary; David W. Brown, salesman in the Bridgeport, Conn., area; William Murphy, salesman in the Boston area.

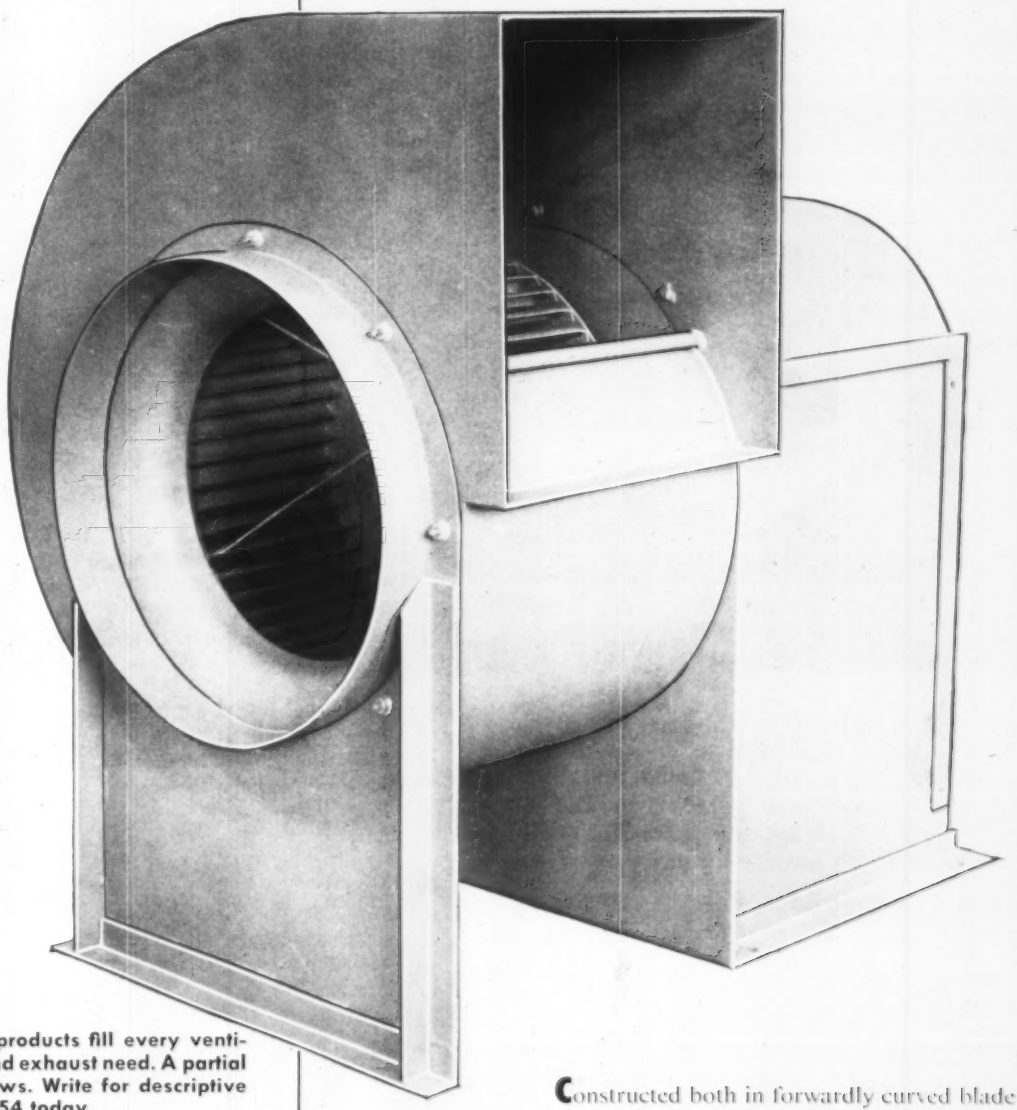
▸ *SOLAR AIRCRAFT CO.*—Ben Dundee, industrial sales representative for northeast district.

▸ *STEWART-WARNER CORP.*—Robert J. Rose, district sales manager in central Illinois for the company's heating and air conditioning division. ∓

*If you need to move air...*

# BARRY

## Belted Ventilating Sets do it BEST!



**BARRY products fill every ventilation and exhaust need. A partial list follows. Write for descriptive bulletin 54 today.**

FC ventilating fans
Induced draft fans
Steel plate fans
Fan wheels and scrolls
BBC ventilation fans
Forced draft fans
Fume exhaust fans
Utility exhausters
Belted ventilating sets
Material handling fans
Medium pressure blowers
Special applications

Constructed both in forwardly curved blade and non-overloading design, and available in 12 sizes to 22,000 cfm, Barry designed units perform your specific job easily and economically . . . Because they are convertible in discharge for ready adaptability, Barry belted ventilating sets get your installations into efficient operation in record time.

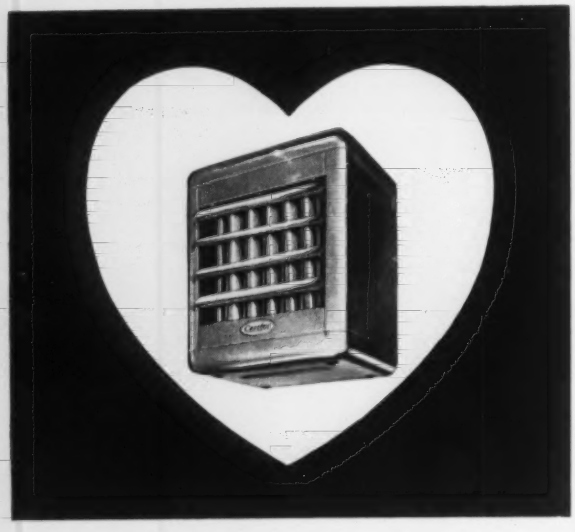
**BARRY BLOWER CO.**
3100 CALIFORNIA ST. N. E. • MINNEAPOLIS 18, MINN.

Carrier Gas-Fired Heaters offer

**TWO BIG ADVANTAGES**

straight from the

"heart of aluminized steel"



long-lasting value plus smart design

**First big advantage:** Carrier Gas-Fired Unit Heaters and Duct Furnaces offer special long-lasting value. Only Carrier has this "heart"—an all-welded heat-exchanger made of 16-gauge aluminized steel. It far outlasts ordinary furnace steel of heavier gauge and ceramic coated metals.

**Second big advantage:** these Carrier Gas-Fired Unit Heaters and Duct Furnaces combine the smart design demanded for the most modern stores and offices . . . with the dependability and performance features that are required by industrial applications.

**Along with these two advantages,** there is also a wide choice—Unit Heaters in 8 sizes, 50,000 to 230,000 Btu/hr. Duct Furnaces in 8 sizes, 50,000 to 230,000 Btu/hr. Look in the Classified Directory under "Heaters—Unit" for the name of your Carrier wholesaler. Or drop a line to Carrier Corporation, Dept. UH, Syracuse, N. Y.

Carrier

**industrial heating • air conditioning • refrigeration**

## WE HEAR THAT . . .

▸ *THERMOWHEEL, INC.* has moved its plant to 50th and Vernon Aves., Long Island City, N. Y.

▸ *U. S. STEEL CORP.* has announced plans to enter the aluminum coated steel sheet market. Commercial production will follow a facility modification program at the corporation's Irvin Works near Dravosburg, Pa.

▸ *GENERAL AIR PRODUCTS CORP.* will act as exclusive sales agent for all air distribution equipment manufactured by *GENERAL REGISTER CORP.*

▸ The central office of *BORG-WARNER CORP.* has been moved to the new Borg-Warner Building at 200 S. Michigan Ave. in Chicago.

▸ *HAGAN CHEMICALS & CONTROLS, INC.* has acquired the name and tangible assets of *KYBERNETTES CORP.*, New York, which manufactures automatic data logging and temperature monitoring equipment.

▸ *ROYCO INSTRUMENTS, INC.* has moved from its Albany location, at which it was founded, to new, enlarged quarters at 874 Fabian Way, Palo Alto, Calif.

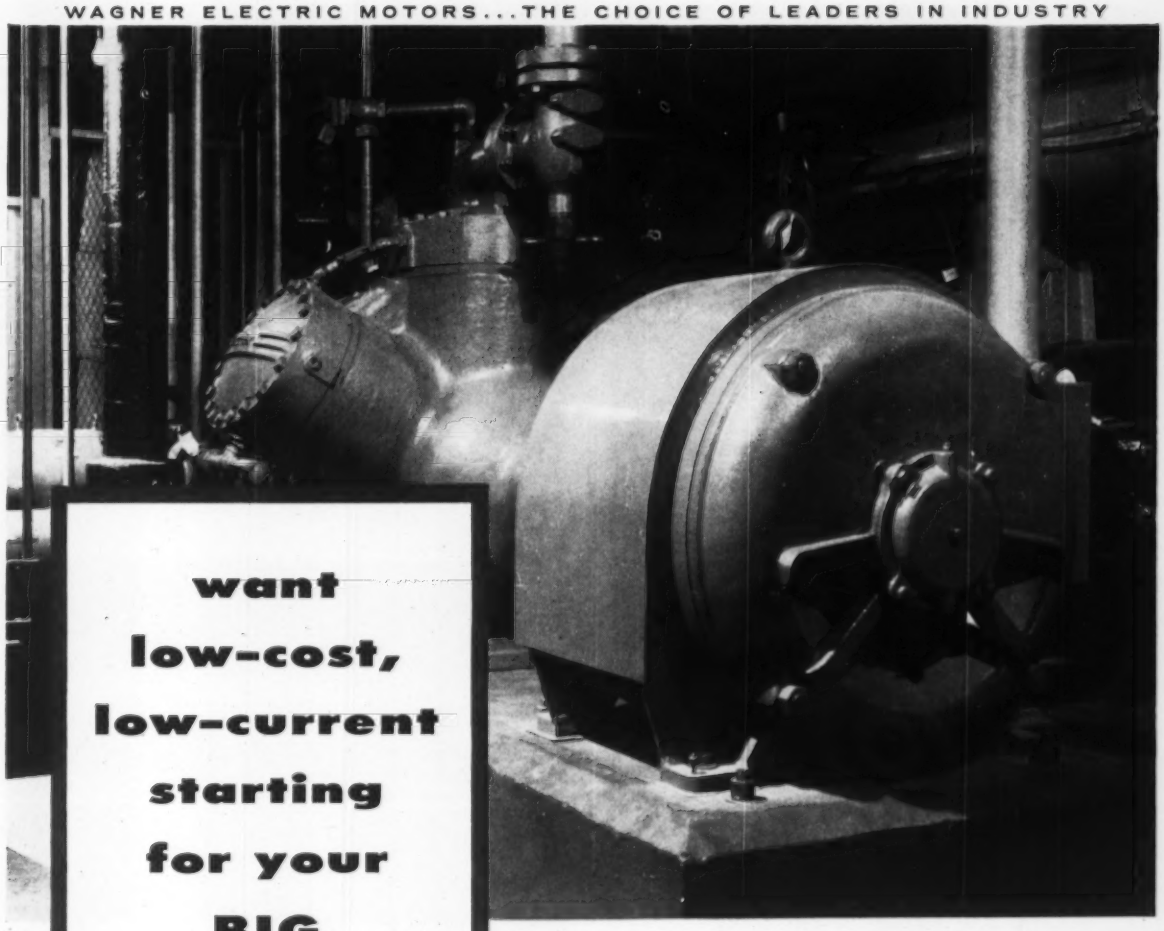
▸ Six La Crosse, Wis., area graduating high school seniors have been awarded two year pre-engineering scholarships by *TRANE CO.* The scholarships have been awarded for the second consecutive year.

▸ *WEIL-McLAIN CO.* held the opening of its new Research and Engineering Laboratory at the company's headquarters on May 16. The laboratory is completely equipped for extensive hydronic research, including investigations concerning the mechanical efficiency of heating, cooling equipment and relative effects on human comfort of radiant and convected heat and various cooling techniques and applications.

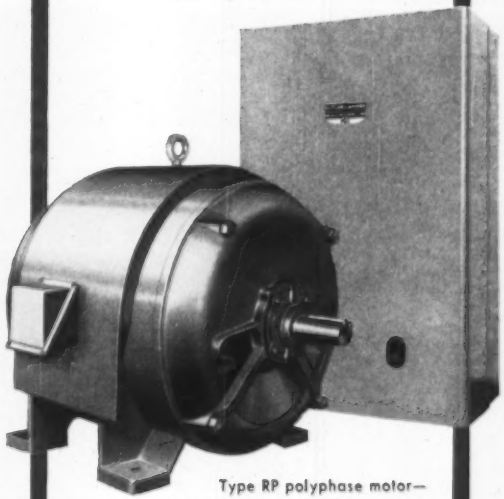
▸ *CAPTS. THOMAS H. URDAHL* and *PAUL S. BAUER, USNR* (Ret.) have joined to form *URDAHL ASSOCIATES*, a professional engineering firm. Both were extremely active during their periods of duty in the Navy in the air conditioning and electronics fields, respectively.

▸ E. J. Bartells Co. and Western Asbestos Co. were honored recently in separate *JOHNS-MANVILLE* luncheon salutes to new members of the Quarter Century Club for Industrial Insulations Contractors.

WAGNER ELECTRIC MOTORS...THE CHOICE OF LEADERS IN INDUSTRY



**want low-cost, low-current starting for your BIG MOTORS?**



Type RP polyphase motor—in ratings to 500 hp. with increment type starter.

## Specify Wagner Increment Motor-Starter Combinations

Part-winding starting is the simple, inexpensive way to limit the inrush of starting current in squirrel-cage motors up to 500 horsepower—and only the Wagner Increment Motor-Starter Combination gives you all these advantages:

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**APPROVED BY POWER COMPANIES**—Meets all polyphase motor starting requirements of AEIC—EEI—NEMA—reduces voltage fluctuations—does not open the line during the starting period.

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## WE HEAR THAT

*Continued*

▸ *BARBER-COLMAN CO.* was one of 15 well known American firms invited to participate in a mechanical exhibit, showing technological advances and contributions to the nation's industrial development made possible under the American patent system. The exhibit was held in the lobby of the Dept. of Commerce Bldg., Washington, D. C.

▸ The Engineering Standards Committee on Control Valves for Fluid Controls Institute met on April 1 at the *CONOFLOW CORP.* to discuss and revise "Recommended Voluntary Standards for Measurement Procedure for Determining Control Valve Flow Capacity, according to an announcement by the *AUTOMATIC SWITCH CO.*

▸ *TRANE CO.* will hold an "Air Conditioning Clinic" at its plant in La Crosse, Wis. It is intended to help train contractors, industrial plant engineers and service personnel in the proper selection, installation, maintenance and servicing of air conditioning equipment for improved system performance.

▸ The new 56 in. hot strip mill went into commercial production on June 3 at *ARMCO STEEL CORP.'s* Butler Works. It is said to be the world's most powerful.

▸ *DUNHAM-BUSH, INC.* has revealed plans to shift all production, which consists of sheet metal forming and coil fabricating operations, from West Hartford to its plant in Michigan City, Ind.

▸ On June 2 a new manufacturing plant with sales, service and warehousing facilities was opened by *LADISH CO.* at 1301 West Belt Dr., N., Houston, Tex. It will serve as the company's Texas division.

▸ *HERMAN NELSON DIV. of AMERICAN AIR FILTER CO.* has purchased a five acre tract of land adjacent to its 25th St. plant in Moline, Ill., for future expansion. The size and type of structure to be erected has not yet been determined.

▸ *DUREZ PLASTICS DIV.* of *HOOKER ELECTROCHEMICAL CO.* has been decentralized and will now operate as an autonomous division of the company. The facilities involved are located at North Tonawanda, N. Y., Kenton, Ohio and Spokane, Wash. ≠


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# MEETINGS & CONVENTIONS

## 1958

*AUG.* 7-9—*North Carolina Hospital Engineers Association, Inc.*, 1958 convention. Sir Walter Hotel, Raleigh, N.C. Headquarters: Oteen, N. C.

*SEPT.* 15-19—*Instrument Society of America*, Instrument-Automation Conference and Exhibit. Philadelphia Convention Hall, Philadelphia. Information: Fred J. Tabery, Exhibit Manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7.

*OCT.* 5-8—*National Association of Corrosion Engineers*, technical session. Hotel Somerset, Boston. NACE headquarters: 1061 M & M Bldg., Houston 2.

*OCT.* 13-15—*National Electronics Conference*, conference and exhibition. Hotel Sherman, Chicago. Information: Rudolph E. Hornacek, publicity committee chairman, c/o Illinois Bell Telephone Co., 208 W. Washington St., Chicago 6.

*OCT.* 13-15—*American Gas Association*, annual convention. Atlantic City. AGA headquarters: 420 Lexington Ave., New York 17.

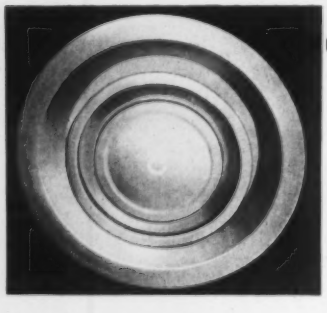
*OCT.* 20-24—*46th National Safety Congress & Exposition*, Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

*OCT.* 21-23—*National Association of Corrosion Engineers*, South Central Region Conference. Roosevelt Hotel, New Orleans. NACE Headquarters: 1061 M & M Bldg., Houston 2.

*OCT.* 22-24—*Air-Conditioning and Refrigeration Wholesalers Association*, annual meeting. Sheraton-Palace Hotel, San Francisco. Information: 2607 N. High St., Columbus, Ohio.

*NOV.* 17-21—*Society of the Plastics Industry, Inc.*, eighth national plastics exposition. International Amphitheater, Chicago. To be held concurrently with the SPI annual national conference, Morrison Hotel, Chicago. SPI headquarters: 250 Park Ave., New York

*DEC.* 1-4—*National Warm Air Heating and Air Conditioning Association*, annual convention. Cleveland, Ohio. Information: 640 Engineers Bldg., Cleveland 14.

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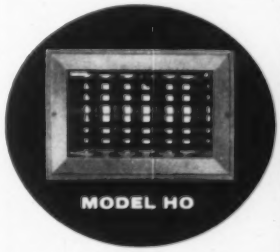


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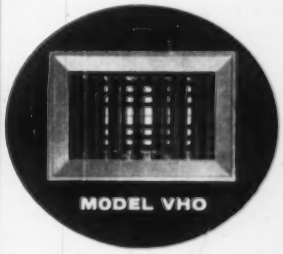
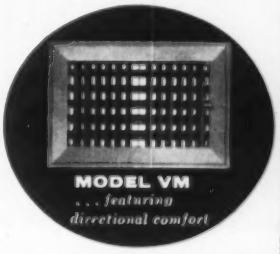



Double Bank Deflection Register With Opposed Dampers.

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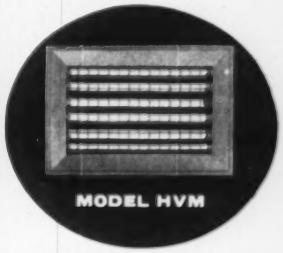


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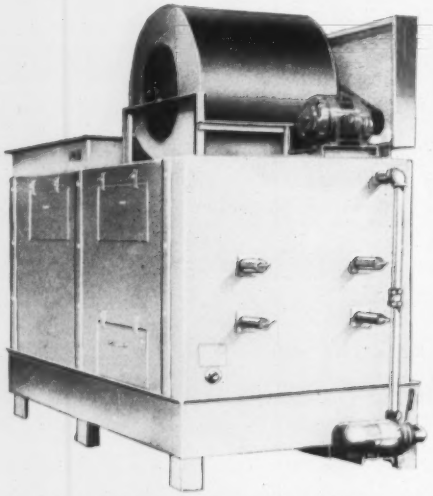

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## MEETINGS & CONVENTIONS *Continued*

### 1958

*DEC.* 1-5—*American Society of Mechanical Engineers*, National Exposition of Power and Mechanical Engineering. New York Coliseum, New York. Information: International Exposition Co., 480 Lexington Ave., New York 17.

### 1959

*JAN.* 26-30—*14th International Heating and Air-Conditioning Exposition*. Philadelphia. Under auspices of the American Society of Heating and Air-Conditioning Engineers, in conjunction with its 65th annual meeting, also in Philadelphia. Exposition management: International Exposition Co., 480 Lexington Ave., New York 17. ASHAE headquarters: 62 Worth St., New York 13.

*JAN.* 26-29—*Plant Maintenance and Engineering Show and Conference*. Cleveland Public Auditorium, Cleveland, Ohio. For information, contact: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

*FEB.* 3-5—*Society of the Plastics Industry, Inc.*, 14th SPI reinforced plastics division conference. Edgewater Beach Hotel, Chicago. SPI headquarters: 250 Park Ave., New York 17.

*APRIL* 1-3—*Gas Appliance Manufacturers Association*, annual meeting. The Greenbrier, White Sulphur Springs, W. Va. GAMA headquarters: 60 E. 42nd St., New York 17. ±

## Obituary

### Edward L. Hogan

EDWARD LAWRENCE HOGAN, formerly of American Blower, Div. of American-Standard, died on March 19, 1958 in Clearwater, Fla. He was born August 29, 1881 at Saginaw, Mich. After receiving a Bachelor of Science degree in Mechanical and Electrical Engineering and a Master of Science degree from the University of Michigan, he joined American Blower in 1907. While with them, he served as manager of the research department, manager of the dust collector department, manager of the air conditioning department, Chicago district manager and consulting engineer until his retirement, August 31, 1946. Mr. Hogan had many inventions to his credit which were patented and assigned to American Blower.

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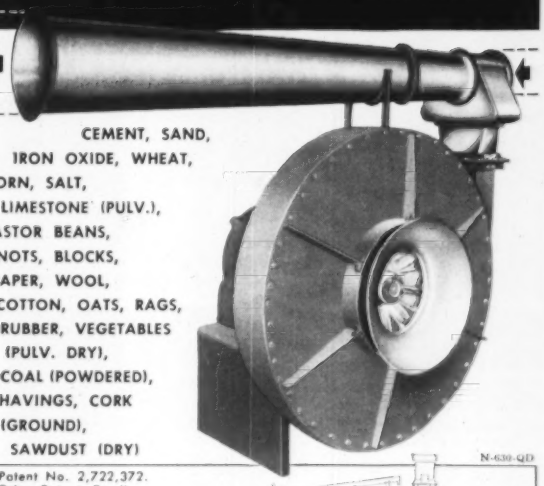

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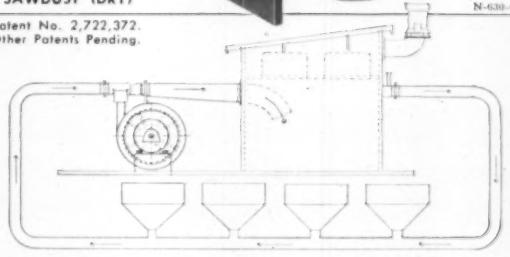
N-630-QD

Patent No. 2,722,372.
Other Patents Pending.



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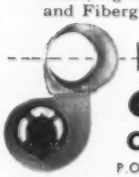

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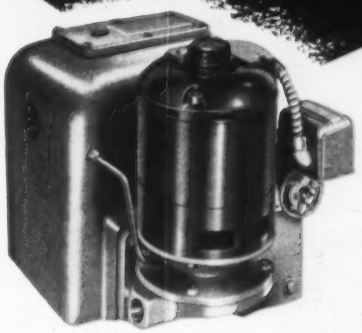

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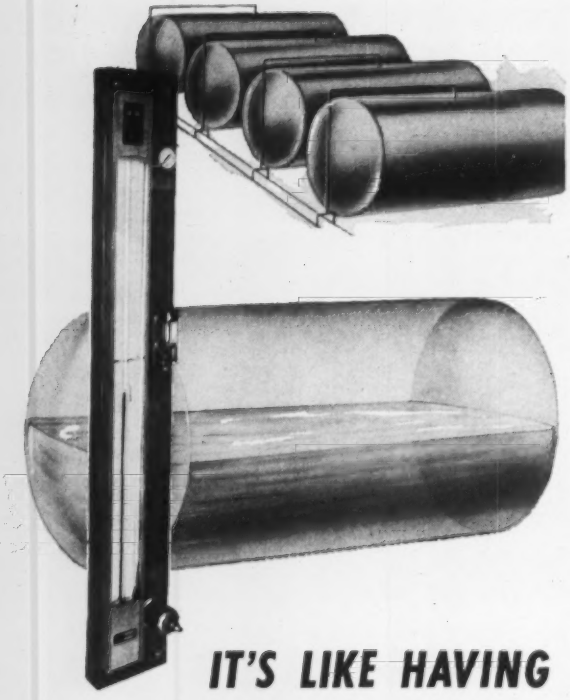

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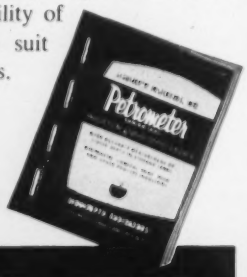


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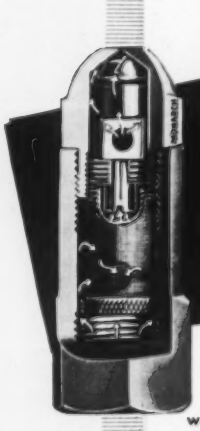
HIGH VELOCITY AIR FILTERS—By T. E. Wright, R. J. Stasny and C. E. Lapple. 277 pp. Donaldson Co., Inc. for Wright Air Development Center, U. S. Air Force. Order PB131570 from OTS, U.S. Department of Commerce, Washington 25, D. C. $6.00.

ELEVATED TEMPERATURE PROPERTIES OF WELDING DEPOSITS AND WELDMENTS—STP 226. 228 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $5.50.

STEEL PIPING MATERIALS—A-I. 460 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $5.00.

ADHESIVES AND SEALANTS IN BUILDING. 160 pp. National Academy of Sciences, 2101 Constitution Ave., Washington 25, D. C. $5.00.

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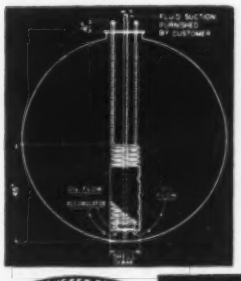

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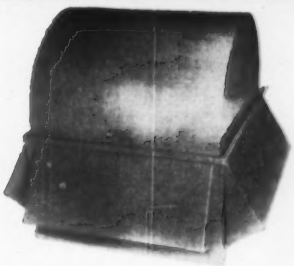

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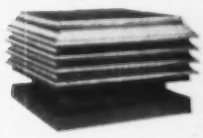

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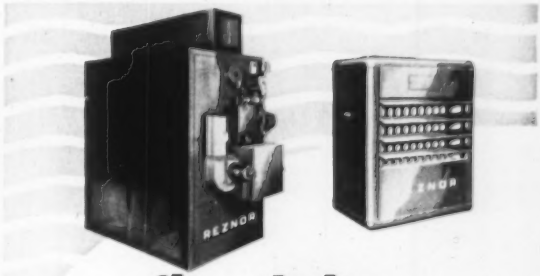


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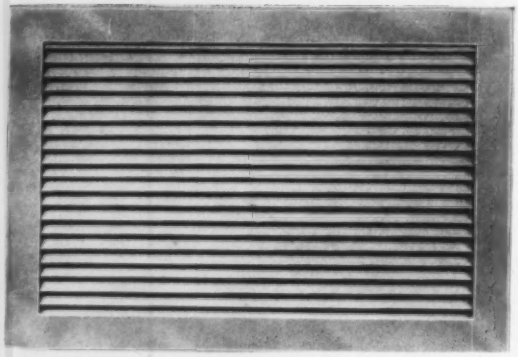

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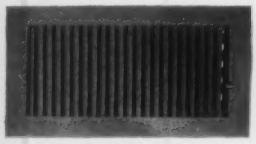

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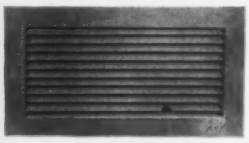

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RECOMMENDED SAFE PRACTICES FOR INERT-GAS METAL-ARC WELDING—Prepared by AWS Committee on Safety Recommendations. 9 pp. American Welding Society, 33 W. 39th St., New York 18. $1.00.

FLOW OF COAL IN BINS—8 pp. Bituminous Coal Research Inc., 121 Meyran Ave. at Forbes, Pittsburgh 13. $.25.

RECOMMENDED PRACTICE FOR STRESS RELIEVING WELDED ATTACHMENTS—Pipe Fabrication Institute, Room 759, One Gateway Center, Pittsburgh 22.

APPRAISAL OF AIR POLLUTION IN TENNESSEE—Prepared jointly by State of Tennessee Dept. of Public Health and Public Health Service, U. S. Dept. of Health, Education, and Welfare. 85 pp. Community Air Pollution Program, Public Health Service, Robert A. Taft Sanitary Engineering Center, Cincinnati. ≠

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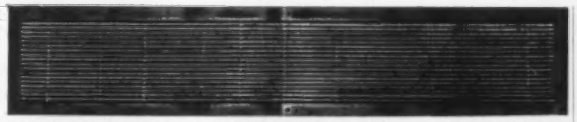

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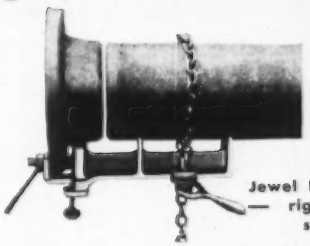

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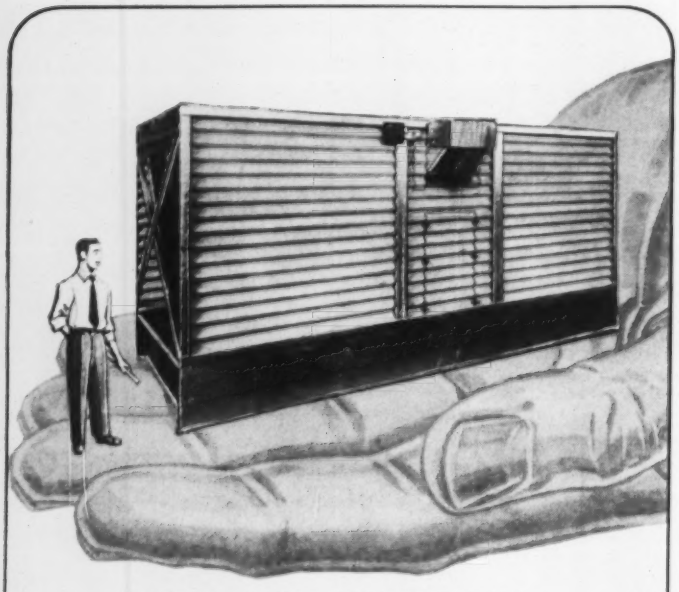

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# Havens "V" series

**80 to 600 Tons**

- Low Silhouette
- All Steel hot-dipped galvanized AFTER fabrication
- Choice of corrugated cement asbestos board (transite) or hot dipped galvanized steel casings.
- Havens cooling tower bearing cuts maintenance costs.
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## INDEX TO ADVERTISERS

Firms represented in this issue are identified by the page on which their advertising appears. Advertising in other issues is marked with an asterisk.

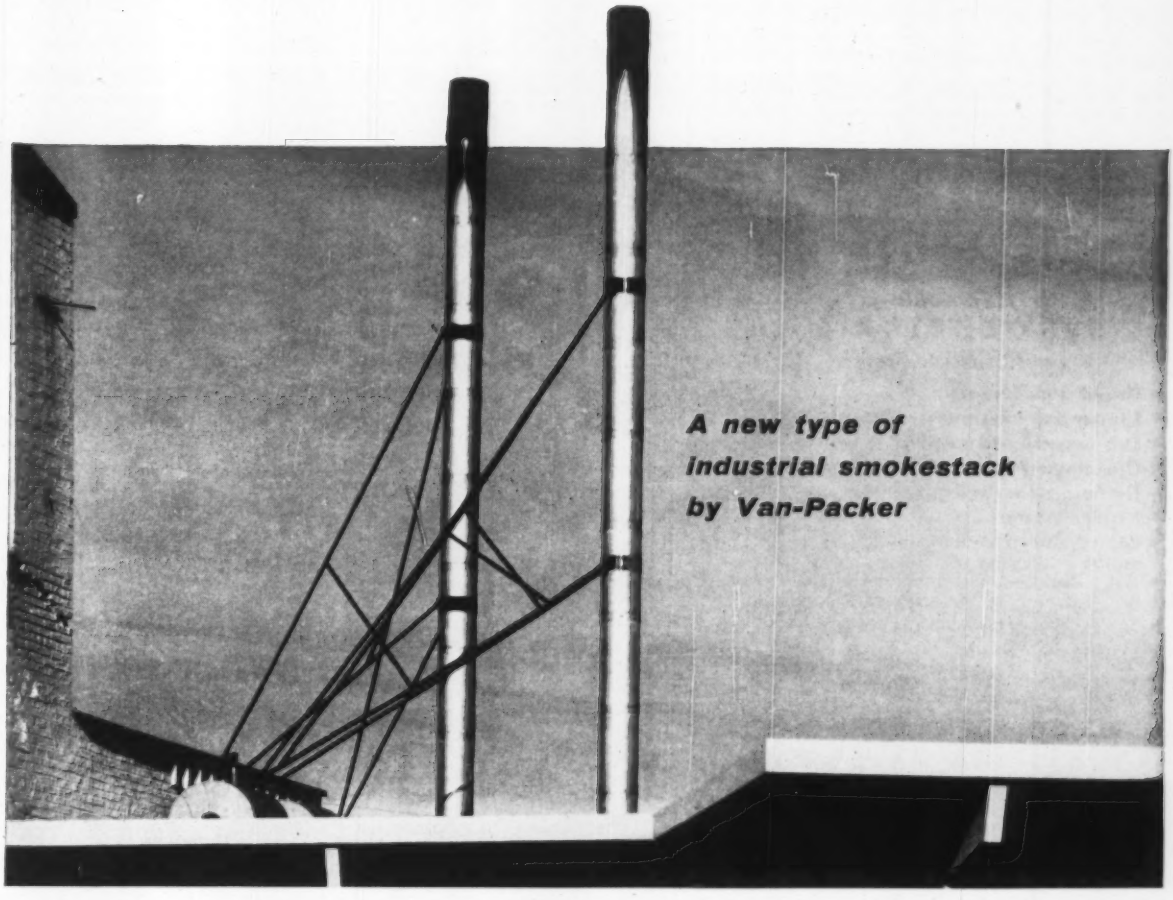

Acme Industries, Inc. . . . *
Adsco Div., Yuba Consolidated Industries, Inc. . . 243
Aerofin Corp. . . . 207
Aerovent Fan Co., Inc. . . . *
Air & Refrigeration Corp. . . . 278
Air Control Products, Inc. . . . *
Air Devices, Inc. . . . 256
Air Filter Institute . . . *
Air-Maze Corp. . . . *
Air Moving & Conditioning Association . . . *
Airtemp Div., Chrysler Corp. . . . 247
Airtherm Mfg. Co. . . . *
A-J Mfg. Co. . . . 270
Aladdin Heating Corp. . . . 250
Alco Valve Co. . . . 34
Allen-Bradley Co. . . . *
Allen Cooler & Ventilator Inc. . . . 164
Allen Mfg. Co., W. D. . . . *
Allis Co., Louis . . . *
American Air Filter Co., Inc. . . . 258
American Blower Corp. . . . 154
American Brass Co., The . . . 58
Amer. Chain & Cable Co., Inc. — R-P&C Valve Div. . . . 203
American Gas Association . . . 48, 49
American Gilsonite Co. . . . *
American Hard Rubber Co. . . . 172
American-Marsh Pumps, Inc. . . . 240
American Metal Hose Branch American Brass Co. 169
American Radiator & Standard Sanitary Corp. Plumbing & Heating Div. . . . *
Ames Iron Works . . . *
Ammerman Co., Inc. . . . 276
Anderson Co., V. D. Div. of International Basic Economy Corp. . . . *
Anemostat Corp. of America . . . 41
Armstrong Cork Co. . . . 42
Armstrong Machine Works . . . 6
Arno Adhesive Tapes, Inc. . . . *
Aurora Pump Co. . . . *

Babbitt Steam Specialty Co. . . . 274
Babcock & Wilcox Co., Tubular Products Div. . . . 54
Badger Mfg. Co. . . . *
Barber-Colman Co. . . . 39
Barnebey-Cheney Co. . . . *
Barry Blower Co. . . . 259
Bell & Gossett Co. . . . 27, 32
Bethlehem Steel Company . . . 33
B-I-F Industries, Inc. . . . *
Binks Mfg. Co. . . . 168
Bituminous Coal Institute . . . *
Boiler Engineering & Supply Co., Inc. . . . *
Bonney Forge & Tool Works . . . *
Bridgeport Brass Co. . . . 241
Bruner Corp., The . . . *
Buensod-Stacey, Inc. . . . *
Buffalo Forge Co. . . . 12, 13
Buffalo Pumps, Inc., Div. of Buffalo Forge Co. 21
Builders-Providence, Inc. Div. of B-I-F Ind., Inc. . . . *
Burgess-Manning Co. . . . 279
Burnham Corporation . . . *
Byers Co., A. M. . . . *

Cain Mfg. Co. . . . 180
Cambridge Filter Corp. . . . 175
Campbell Heating Co. . . . 239
Canton Stoker Corp., Wagener Pump Div. . . . *
Capitol Mfg. & Supply Co. . . . 218
Carey Elec. Engr. Co. . . . *
Carnes Corporation . . . 52
Carrier Corp. . . . 193, 260
Carpenter & Paterson, Inc. . . . 242
Carver Pump Co. . . . *
Century Electric Co. . . . 60, 61
Chase Brass & Copper Co. . . . 155
Chesapeake and Ohio Railway . . . *
Chester Cable Co. . . . *
Chicago Blower Corp. . . . 237
Chicago Pump Co. . . . 235
Clarage Fan Co. . . . Inside Back Cover
Cleaver-Brooks Co., Boiler Div. . . . 166
Colonial Plastics Mfg. Co. Subsidiary Van Dorn Iron Works Co. . . . 192
Committee on Industrial Ventilation . . . 258
Committee on Steel Pipe Research American Iron & Steel Institute . . . 233
Connor Engineering Corp. . . . *
Continental Air Filters, Inc. . . . 31
Crane Co. . . . 65
Curtis Refr. Machine Div. of Curtis Mfg. Co. . . . 231
Cyclotherm Div., National U. S. Radiator Corp. 176

Davis Eng. Corp. . . . 181, 182
DeBothezat Fans Division American Machine & Metals, Inc. . . . 3
Detroit Stoker Co. . . . *
DeZurik Corporation . . . *
Diamond Mfg. Co. . . . 271
Dodge Mfg. Co. . . . *
Dover Mfg. Co. . . . *
Dravo Corp. . . . *
Drayer-Hanson, Div. of Natl-U.S. Radiator Corp. 266


Continued on page 274

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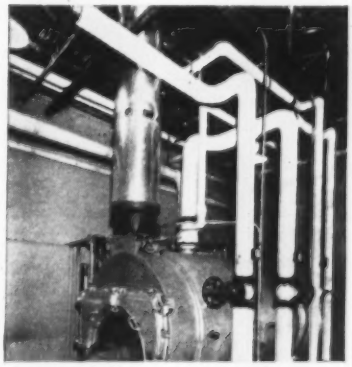

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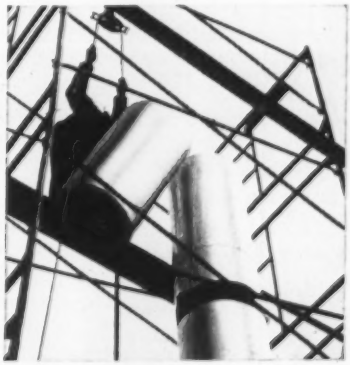

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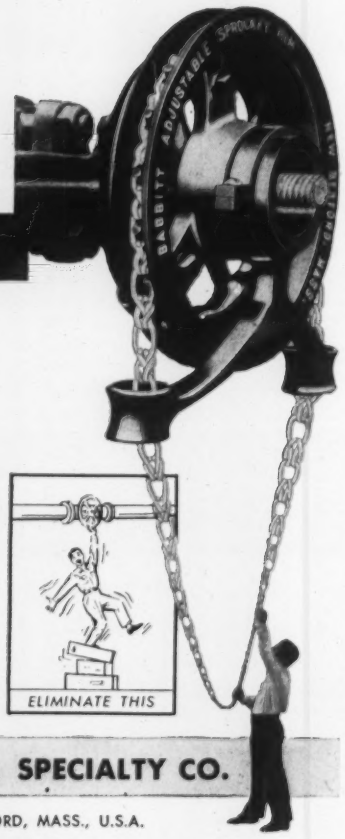


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## INDEX TO ADVERTISERS

Continued from page 272


Dresser Mfg. Division ... 227
Dunham-Bush, Inc. ... 4
Durabla Mfg. Co. ... *
Duro-Dyne Corp. ... *
Dwyer Mfg. Co., F. W. ... 278

Eagan Co., Inc., Walter H. ... *
Elgen Mfg. Corp. ... *
Ellicott Fabricators, Inc. ... 194
Elliott Co., div. of Carrier Corp. ... *
Embassy Steel Products ... *
Emerson Electric Mfg. Co. ... 229
Enterprise Div.
General Metals Corp. ... 202
Evans Corp., The George ... *
Everlasting Valve Co. ... 167

Fairbanks Co., The ... *
Fairbanks, Morse & Co. ... 228
Fairmont Aluminum Co. ... *
Farr Co. ... *
Fedders-Quigan Corp. ... *
Field Control Div., H. D. Conkey & Co. ... *
Finn & Co., Inc., T. R. ... 214
Finnigan Co., J. J. ... *
Fisher Governor Co. ... 37
Fitzgibbons Boiler Co., The ... 206
Flexible Tubing Corp. ... *
Flexonics Corp. ... 191
Fluor Products Co. ... *
"Freon" Products div., duPont de Nemours & Co. Inc., E. I. ... 50
Frick Co. ... 30
Fulton Sylphon Div., Robertshaw-Fulton Cont. Co. ... *
Furnas Electric Co. ... *

G. & O. Mfg. Co., The ... 276
Gallaher Co., The ... 29
General Air Products Corp. ... 264
General Blower Co. ... *
General Chemical Division, Allied Chemical Corp. ... 15
General Controls Co. ... 8, 9
General Electric Co. ... *
Glo-Brite Products ... *
Goodall Rubber Co. ... 208
Goodrich, Chemical Co., B. F. ... *
Goodrich, B. F., Sponge Products Div. ... *
Goodyear Tire & Rubber Co., Inc. ... *
Gordon & Piatt, Inc. ... 254
Governair Corp. ... *
Grasselli Chemicals Dept., duPont de Nemours & Co., Inc. E. I. ... 225
Green Fuel Economizer Co., Inc. ... *
Greenheck Fan & Ventilator Corp. ... 269
Greenlee Tool Co. ... 224
Grinnell Co., Inc. ... Inside Front Cover
Gustin-Bacon Mfg. Co. ... *

Hagan Chemicals & Controls, Inc. ... 226
Halstead & Mitchell ... *
Hammond Brass Works ... 47
Handy & Harman ... *
Hansson, Elof, Inc. ... *
Hart & Cooley Mfg. Co. ... *
Havens Structural Steel Co., Cooling Tower Div. ... 272
Hayes Furnace Mfg. & Supply Co. ... 38
Hastings-Raydist, Inc. ... *
Hendrick Mfg. Co. ... 232
Henry Valve Co. ... *
Hoffman Specialty Mfg. Corp. ... 18
Homestead Valve Mfg. Co. ... *
Howell Electric Motors Co. ... *
Hussey & Co., C. G. ... *

Ilg Electric Ventilating Co. ... 161, 162, 163
Illinois Engineering Co., Div. of American Air Filter Co. ... 258
Illinois Testing Laboratories ... *
Independent Register Co., The ... *
Industrial Acoustics Co., Inc. ... 7
Industrial Combustion, Inc. ... 178
Ingersoll-Rand Co. ... 220
International Boiler Works Co., The ... *
Iron Fireman Mfg. Co. ... 165

Jackson & Church Div. of York-Shipley Inc. ... *
Janitrol Heating & Air Conditioning Div., Surface Combustion Corp. ... 215, 216
Jenkins Bros., Inc. ... 156
Jenn-Air Co., Inc. ... 255
Jewel Mfg. Co., Inc. ... 271
Johns-Manville ... 44, 45, 263
Johnson Heater Corp. ... *
Johnson Co., S. T. ... *
Johnson Service Co. ... Outside Back Cover
Jones & Laughlin Steel Corp. ... *
Joy Mfg. Co. ... *

Kathabar Air Conditioning & Drying Div., Surface Combustion Corp. ... 245
Keasbey & Mattison Co. ... *
Kennard Corp. ... *
Kennedy Valve Mfg. Co. ... *
Kewanee Boiler Division of American Standard ... *


Continued on page 276

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*by cutting your duct cost!*

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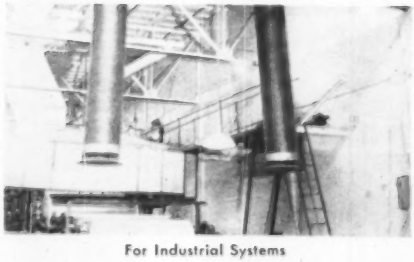

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## INDEX TO ADVERTISERS

Continued from page 274


| | |
|---|---|
| Klipfel Valves, Inc. div. of Hamilton-Thomas Corp. | * |
| Koppers Co., Inc., Fan Dept. | 212 |
| Koppers Co., Inc., Industrial Sound Control Dept. | 28 |
| Kramer Trenton Co. | 190 |
| Lennox Industries, Inc. | * |
| Lewin-Mathes Co. | 43 |
| L. O. F. Glass Fibers Co. | 24 |
| Lunkenheimer Co., The | * |
| Manning & Lewis Engineering Co. | * |
| Marathon Electric Mfg. Corp. | * |
| Marley Co., The | * |
| Marlo Coil Co. | * |
| Marsh Heating Equipment Co. | 197 |
| McDonald Mfg. Co., A. Y. | * |
| McDonnell & Miller, Inc. | 51 |
| McQuay, Inc. | 25 |
| Mercoid Corp., The | * |
| Mettler Div., Eclipse Fuel Engrg. Co. | * |
| Mid-Continent Metal Prod. Co. | 234 |
| Midwest Piping Company, Inc. | 20 |
| Miller Electric Mfg. Co., Inc. | * |
| Miller Valve Co., Inc. | 230 |
| Minnesota Mining & Mfg. Co. | * |
| Minneapolis-Honeywell Regulator Co. | 183, 184, 185, 186, 187, 188, 189 |
| Miracle Adhesives Corp. | * |
| Modine Mfg. Co. | * |
| Monarch Mfg. Works, Inc. | 268 |
| Moore, Inc., Goodloe E. | 218 |
| Morrison Products, Inc. | * |
| Mortell Co., J. W. | 270 |
| Mt. Hawley Mfg. Co. | * |
| Multi-Vent Div., Pyle-National Co., The | 205 |
| Murray Mfg. Co., D. J. | 236 |
| Myers & Bro., F. E. | * |
| Nash Eng. Co., The | 68 |
| National Heater Co., The | * |
| National Tube Div., United States Steel Corp. | * |
| National-U. S. Radiator Corp. | 170 |
| Nelson, Herman Div. of American Air Filter Co., Inc. | 258 |
| Nesbitt, Inc., J. J. | * |
| New York Blower Co., The | 151 |
| Niagara Blower Co., The | 222 |
| NIBCO Inc. | * |
| Norman Products Co. | * |
| Norwood Prod. Co., Div. of A. R. Wood Mfg. Co. | * |
| Oakite Products, Inc. | 248 |
| Ohio Brass Co. | * |
| Ohio Injector Co., The | * |
| Orr & Sembower, Inc. | * |
| Oster Mfg. Co. | * |
| O T M Corp. | * |
| OverHead Heaters, Inc. | * |
| Palmer Thermometers, Inc. | * |
| Pantex Mfg. Corp. Hydraulic Div. | * |
| Paragon Electric Co. | * |
| Patterson-Kelley Co., Inc., The | * |
| Peerless Electric Co., The | 40 |
| Peerless Pump Div., Food Machinery and Chemical Corp. | 223 |
| Penn Ventilator Co. | 238 |
| Pennsalt Chemicals Corp. | * |
| Petro | 23 |
| Petrometer Corp. | 268 |
| Phelps Dodge Copper Products Corp. | * |
| Phillips Cooling Tower Co., Inc. | 173 |
| Pittsburgh Plate Glass Co., The Fiber Glass Division | 16 |
| Porter & Co., H. W. | 179 |
| Porter Co., Inc., H. K., WS Fittings Div. | * |
| Portmar Boiler Co., Inc. | 244 |
| Powell Valves | 177 |
| Power Line Fan Co., Div. of Chelsea Fan & Blower, Inc. | * |
| Powers Regulator Co. | 17, 149 |
| Precision Thermometer & Instrument Co. | * |
| Preferred Utilities Mfg. Corp. | * |
| Pritchard Co. of California, J. F. | * |
| Propellair Div., Robbins & Myers, Inc. | * |
| Quickdraft Company | 267 |
| Radiator Specialty Co. | 271 |
| Ramset Fastening System Winchester-Western Div., Olin Mathieson Chemical Corp. | 200 |
| Ray Burner Co. | * |
| Raypak Co., Inc. | 262 |
| Reading Tube Corp. | 14 |
| Recold Corp. | * |
| Reed Mfg. Co. | 174 |
| Reflectal Corporation | * |
| Reliance Electric & Eng. Co. | * |
| Reliance Gauge Column Co. | 198 |
| Remington Arms Co. | 221 |
| Rempe Co. | 269 |


Continued on page 278

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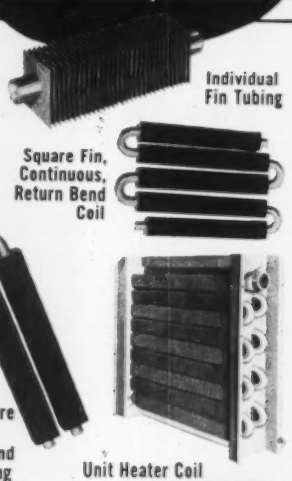
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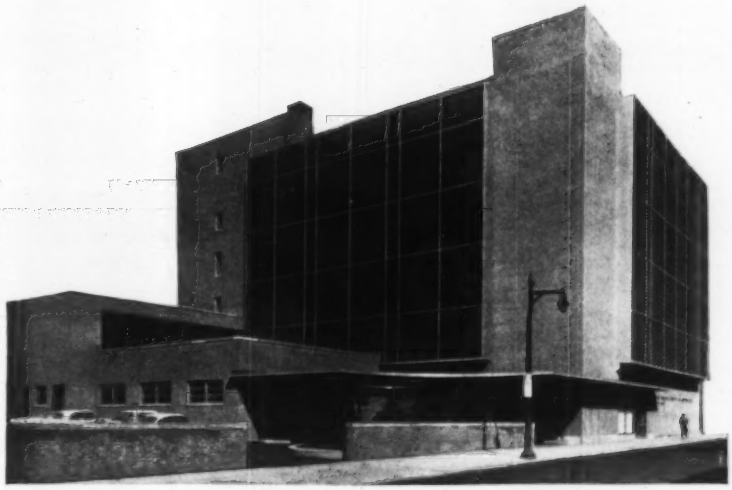

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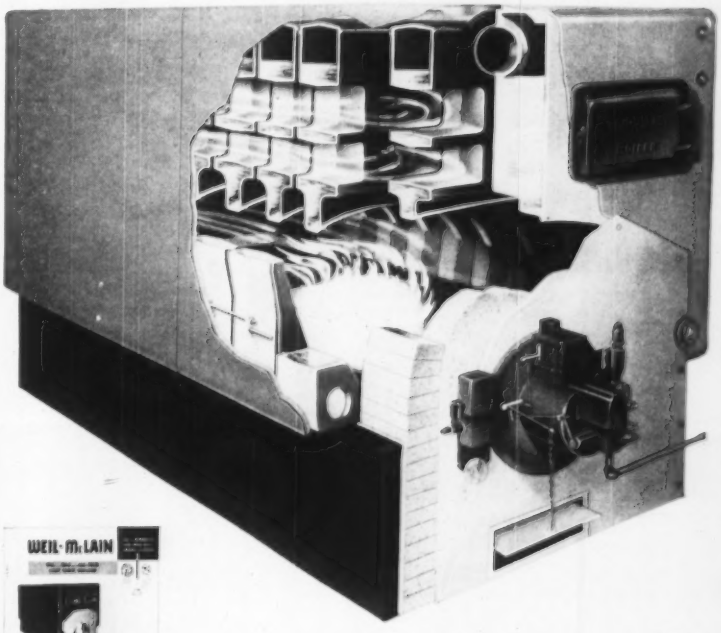

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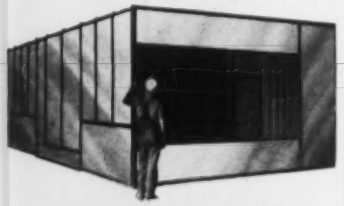

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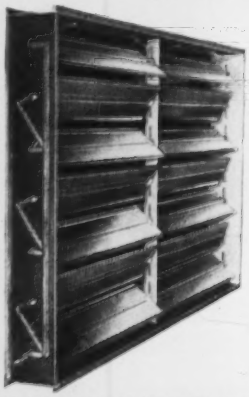

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## INDEX TO ADVERTISERS

Continued from page 276


Republic Steel Corp. 219
Research Products Corp. *
Revere Copper & Brass, Inc. 257
Reznor Mfg. Co. 269
Richmond Engineering Co., The 63
Ric-wil, Inc. 217
Ridge Tool Co., The 179
Roberts-Gordon Appliance Corp. *
Robvon Backing Ring Co. 213
R-P & C Valve Div. — Amer. Chain & Cable Co., Inc. 203
Rotherm Engineering Co., Inc. *

St. Clair Rubber Co. 269
Sarco Co., Inc. *
Sarcotherm Controls, Inc. *
Shaw-Perkins Mfg. Co. 222
Siemon Mfg. Co. *
Skidmore Corp. 153
Slant-Fin Radiator Corp. 19
Sonoco Products Co. 275
Spang-Chalfant Div. of The National Supply Co. 26
Speedline Fittings Div. Horace T. Potts Co. *
Spence Eng. Co. 195
Sporlan Valve Co. *
Standard Stamping & Perforating Co. 265
Stephens-Adamson Mfg. Co. *
Sterling Engrg. & Mfg. Corp. *
Sterling, Inc. 267
Stic-Klip Mfg. Co. *
Stoddard Industries, Inc. 263
Superior Combustion Industries, Inc. 22
Surface Combustion Corp. 215, 216, 245
Swartwout Co., The 209

Taco Heaters, Inc. *
Taylor Forge & Pipe Works *
Taylor Instruments Cos. *
Thermal Engineering Corp. 46
Titus Mfg. Co. *
Titusville Iron Works Co. The Div. of Struthers Wells Corp. *
Torrington Mfg. Co. 199
Trane Co., The *
Trerice Co., The H. O. *
Tube Turns, Inc. *
Tuthill Pump Co. 236
Tuttle & Bailey Div. of Allied Thermal Corp. *
Typhoon Air Conditioning Co., Inc. *

United Cork Companies 196
U. S. Flexible Metallic Tubing Co. 204
United States Gauge Div., American Machine & Metals, Inc. 35, 36
United States Register Co. *
United States Rubber Co. 159
United States Steel Corp. 53
United Wire & Supply Co. *

Van Packer Co., Div. of The Flintkote Co. 273
Vibration Mountings, Inc. 198
Vilter Mfg. Co., The *

Wagner Electric Corp. 261
John Waldron Corporation 280
Walker Mfg. & Sales Corp. *
Walworth Co. *
Waterloo Register Co. 253
Watts Regulator Co. 67
Webster & Co., Warren 57
Webster Engineering Co., The 246
Weil-McLain Co. 277
Weil Pump Co. 252
Weinman Pump Mfg. Co., The *
Weirton Steel Co. 150
Westinghouse Electric Corp., Apparatus Div. *
Westinghouse Electric Corp., Sturtevant Div. 171
Wheatland Tube Co. *
Wheel Trueing Tool Co. *
Wheelco Instrument Div., Barber-Colman Co. *
Wheeling Steel Corp. *
Whitlock Mfg. Co., The *
Will-Burt Company, The *
Williams Gauge Co. 212
Wilson Engrg. Co. *
Wilson Inc., Grant *
Wing Mfg. Co., L. J. div. of Aero Supply Mfg. Co., Inc. 10, 11
Wiremold Co., The *
W-K-M div. of ACF Industries, Inc. 180
Wolverine Tube Div. of Calumet & Hecla, Inc. 152
Worcester Valve Co., Inc. *
Worthington Corp. 251

Yarnall-Waring Co. *
York Corp. 201
York-Shipley, Inc. *
Youngstown Sheet & Tube Co. 249
Yuba Consolidated Industries, Inc., Adsco Div. 243
Yuta Water Heaters, Inc. 210, 211

Zallea Bros. *
Zonolite Co. *



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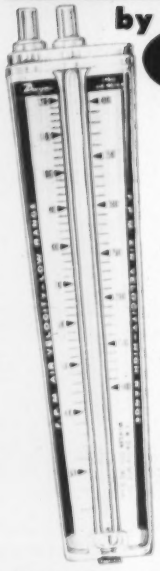

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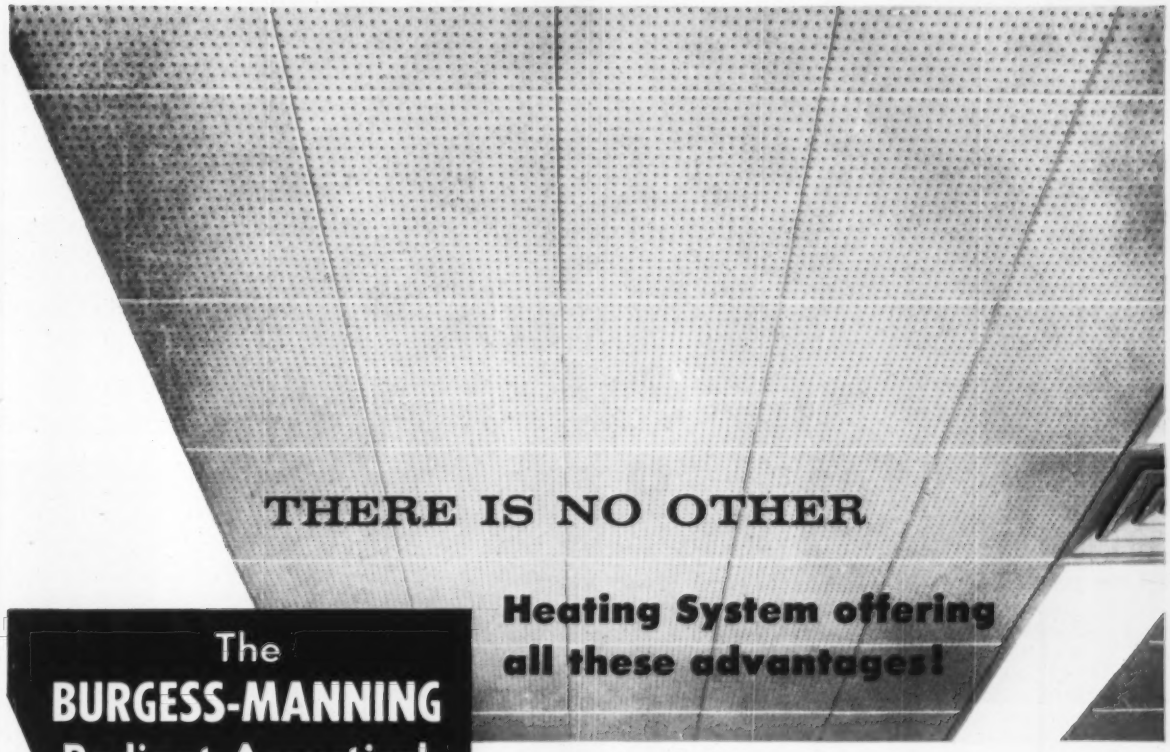

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*Architectural Products Division*

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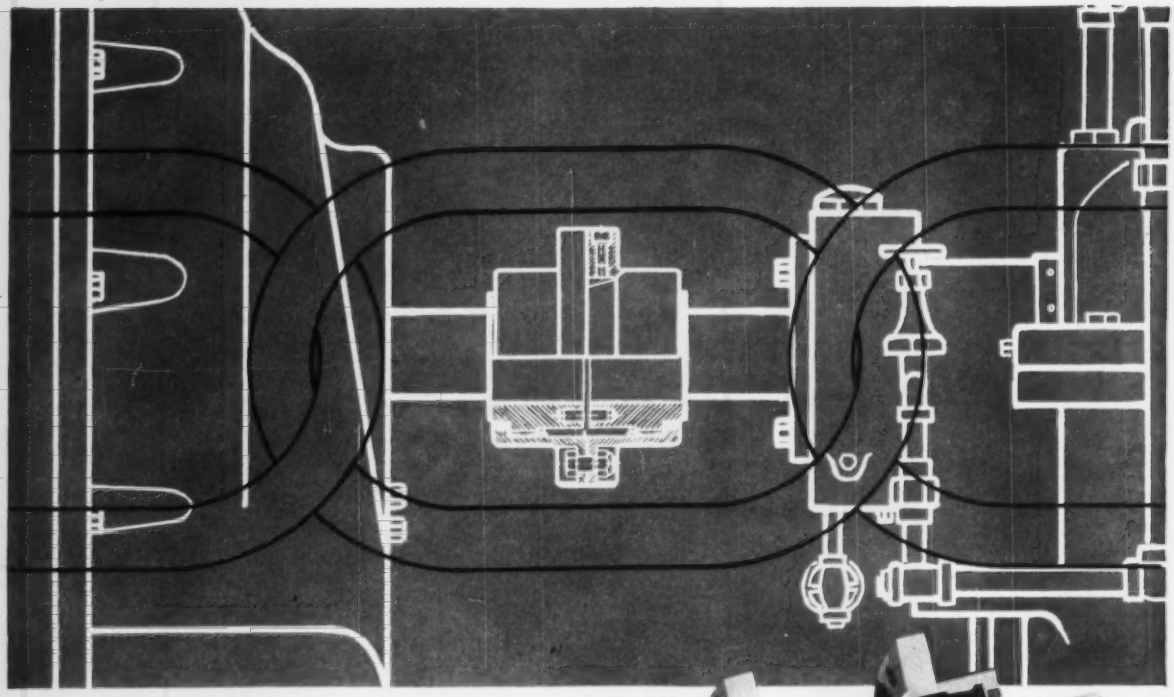

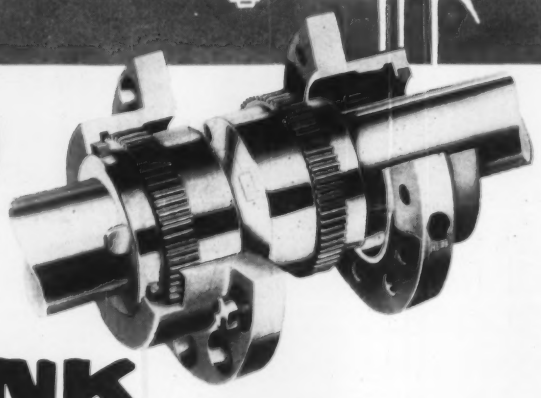

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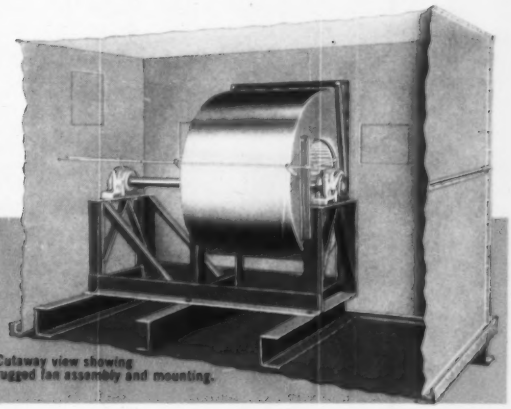

Cutaway view showing rugged fan assembly and mounting.

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**INTRODUCED IN 1954** by Clarage, this new line of Draw-Thru type units fully answers the requirements of conduit type systems where high duct velocities and pressures to 8" static are involved.

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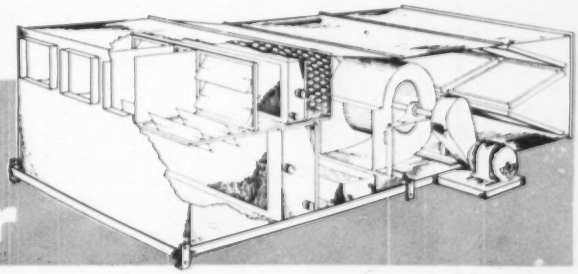

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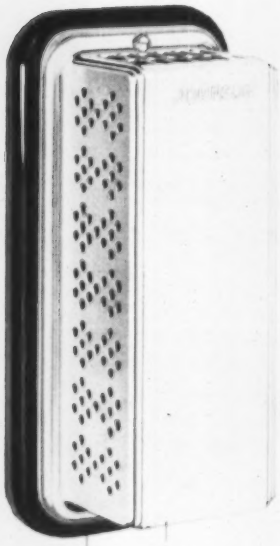

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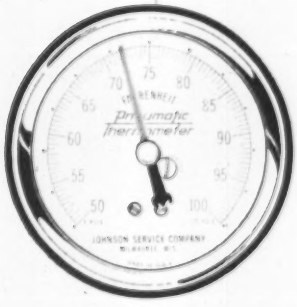


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